Towards a formal model of word meaning negotiation

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Abstract

We introduce a model of the interactive semantics of word meaning negotiation (WMN). We represent a WMN as a growing graph whose nodes are semantic *anchors* and edges are proposed (agent-specific) semantic *links* between them.

Word meaning negotiation is a conversational routine in which speakers explicitly discuss the meaning of a word or phrase. WMNs occur when one participant disagrees with or doesn't understand what a speaker meant by a particular word or phrase. Such a discrepancy represents a breakdown in the alignment of participants' lexico-semantic resources.

1 Background

Although WMN has not received a great deal of attention as such, it has been addressed in the language acquisition literature (e.g., Varonis and Gass, 1985; Clark, 2007) and in psycholinguistic research on semantic alignment (Brennan and Clark, 1996; Metzing and Brennan, 2003).

Myrendal (2015) gives an in-depth qualitative analysis of WMN in Swedish online discussion forums. We seek to model two key findings from that work. First, we aim to capture the distinction between WMNs originating in non-understanding (NON) and those originating in disagreement (DIN). Myrendal (2015, §3.4.1) finds that the source of the discrepancy plays an important role in the trajectory of the WMN. Second, we would like to define *semantic operations* (Myrendal, 2015, §4.5 & 5.6) as actions within the framework of our model and predict the results of those actions.

Along these lines, Larsson and Myrendal (2017) give a Type Theory with Records (TTR) formalization of updates carried out by semantic operations. Where that formalization is restricted to updates resulting from *accepted* semantic operations in isolation, our model seeks to capture the interactive features of WMNs, including rejected proposals and sequences of semantic operations.

The Trigger-Indicator-Response (TIR) model (Varonis and Gass, 1985) captures the discourse structure of WMNs[1], which is an important prerequisite to understanding their semantics. It identifies three utterances that characterize WMNs: A *trigger*, by speaker A, which includes a lexical item (the *trigger word*) that is not understood by speaker B, an *indicator*, in which B signals their non-understanding (or disagreement) of the trigger word, and a *response*, in which A overtly acknowledges the non-understanding.

	Speaker	Utterance
U1	**a**	I have a whistle, 5 dollars...
U2	**b**	A whistle?
U3	**a**	It's to make noise with your mouth when you need help... do you know?
U4	**b**	Oh yeah, it's good.

Example 1: From Yanguas (2010, p. 78) with trigger (U1), indicator (U2), response (U3), and reply to the response (U4).

2 Model

We model a WMN as a growing, rooted, labeled, graph whose nodes are meaningful units called *semantic anchors*, and edges are proposed (speaker-specific) *links* between those anchors. Speaker contributions create new anchors, create links between anchors, and change the relation expressed

[1]The TIR model was designed for NONs, though some of the same concepts carry over to DINs.

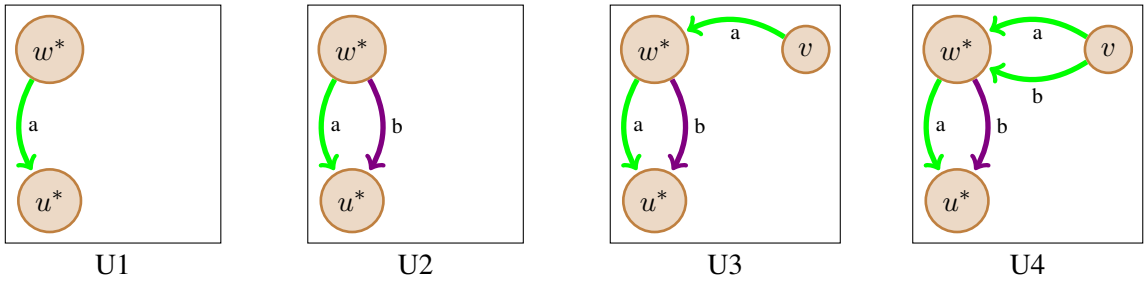

Figure 1: WMN model for Example 1. Link color indicates the semantic relation (green = +, violet = ?). w^* = "whistle", u^* = the situation under discussion, v = "to make noise with your mouth..."

by existing links. In this way, we seek to capture the intuition that speakers jointly "triangulate" the meaning of a target term by situating it in relation to other agreed-upon meanings.

Formally, a WMN of consisting of T utterances between a set of speakers, S, about target term, w^*, is given by:

$$G^t = \langle N, w^*, L, \{R_a\}_{a \in S} \rangle_{t \leq T}$$

where N is the set of anchors introduced by the agents, L is a set of semantic relations, and each $R_a : N \times N \rightarrow L$ gives the kind of semantic relation (if any) posed by a.

For now, we assume three semantic relations: $L = \{+, -, ?\}$. Roughly, $R_a(u, v) = +$ means a asserts that u *applies to* v and $R_a(u, v) = -$ means that a asserts u *does not* apply to v. If a raises the question of the semantic relation between u and v without making an assertion, we write $R_a(u, v) = ?$. Note that this is a directed relation: $R_a(u, v) = +$ is different from $R_a(v, u) = +$, and links (possibly with different semantic relations) may exist in both directions. More precisely, we use $R_a(u, v) = +$ when a asserts that u is a *partial definition* (supplying necessary but not sufficient conditions) for v, or that v is *an example of* u.[2]

In contrast to Larsson and Myrendal (2017), this model captures WMNs at the level of *understanding* (Clark and Schaefer, 1989). Grounding at the level of *uptake* is achieved when $R_a(u, v) = R_b(u, v)$ for all $a, b \in S$.

2.1 Semantic operations

Speaker contributions can add any number of semantic anchors and/or links, or change the relation expressed by existing links. As a result, G is monotone increasing, that is; for each $t \leq T$, $N^t \subseteq N^{t+1}$ and $Dom(R_a^t) \subseteq Dom(R_a^{t+1})$.

Now we can define some of the semantic operations from Myrendal (2015) in terms of the model:

- **exemplify** – u is an example of v
  - create a new anchor, u (the example)
  - create a link $R_a(v, u) = +$
- **explicate** – u is a (partial) definition of v
  - create a new anchor u (the explication)
  - create a link $R_a(u, v) = +$
- **endorse** – u is a v
  - create a link $R_a(u, v) = +$ between existing anchors u and v.
- **meta-linguistic CR** – what do you mean by u?
  - create a link $R_a(u, v) = ?$ between existing anchors, u and v

This is not an exhaustive list, but demonstrates how semantic operations can be defined in terms of the atomic actions offered by the model.

3 Future Work

There are two main lines of future work. First, the model should define *semantic updates* based on the state of the graph (i.e., taking the entire sequence of semantic operations into account). This would achieve our goal of giving an interactive update semantics for word meaning negotiation. Second, we intend to develop an annotation schema for semantic operations from which we can derive the WMN graph. From there, we can test the adequacy of the model by making predictions about how agents will use negotiated terms in the future.

[2] Depending on the underlying semantic representation, this overloading may be problematic. In TTR, both partial definitions and (verbal) examples correspond to the *subtype* relation ($\sqsubseteq$), but examples given by demonstration are more adiquately modeled by the *of type* relation (:).

References

Susan E Brennan and Herbert H Clark. 1996. Conceptual Pacts and Lexical Choice in Conversation. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, 22(6):1482.

Eve V. Clark. 2007. Young Children's Uptake of New Words in Conversation. *Language in Society*, 36(2):157–182.

Herbert H. Clark and Edward F. Schaefer. 1989. Contributing to discourse. *Cognitive Science*, 13(2):259–294.

Staffan Larsson and Jenny Myrendal. 2017. Dialogue Acts and Updates for Semantic Coordination. In *SEMDIAL 2017 (SaarDial) Workshop on the Semantics and Pragmatics of Dialogue*, pages 52–59. ISCA.

Charles Metzing and Susan E Brennan. 2003. When conceptual pacts are broken: Partner-specific effects on the comprehension of referring expressions. *Journal of Memory and Language*, 49(2):201–213.

Jenny Myrendal. 2015. *Word Meaning Negotiation in Online Discussion Forum Communication*. PhD Thesis, University of Gothenburg, University of Gothenburg.

E. M. Varonis and S. Gass. 1985. Non-native/Non-native Conversations: A Model for Negotiation of Meaning. *Applied Linguistics*, 6(1):71–90.

Inigo Yanguas. 2010. Oral Computer-Mediated Interaction between L2 Learners: It's about Time! *Language Learning & Technology*, 14(3):72–93.