

# Does semantic negotiation predict semantic change?

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## Abstract

This project uses distributional semantics to investigate the relationship between semantic negotiation and historic semantic change, two sources of semantic variation. We hypothesize that semantic negotiation is the mechanism by which historic semantic change occurs, and that intra-dialogue semantic dynamics can therefore predict shifts in meaning on the global level.

## 1 Background

Successful communication requires lexico-semantic overlap among speakers; they must agree, at least to some degree, on the meaning of the words they use. Nevertheless, a given expression often has different meanings across uses, even within the same language. Sources of semantic variation include differences between speech communities, diversity of personal linguistic style, polysemy and homophony, historic semantic change, and dialogical semantic adaptation. In this project, we examine the relationship between these last two categories. In particular, we look for evidence that semantic adaptation in dialogue predicts historic semantic change.

### 1.1 Semantic Adaptation

Over the course of a dialogue, participants collaborate to establish and refine a *common ground* that supports further communication (Clark and Schaefer, 1989). Common ground includes *semantic alignment*: dialogue-specific conventions about the meaning of new and existing lexical items (Brennan and Clark, 1996).

Semantic alignment takes place through *semantic negotiation*. Dialogue participants negotiate the meaning of lexical items both *implicitly* (when a particular use is accepted by the listener) and *explicitly* (through clarification and repair) (Larsson, 2007; Mills and Healey, 2008). Negotiation allows speakers to adapt the meaning of expressions to facilitate their particular communicative needs.

### 1.2 Historic Semantic Change

By *historic semantic change*, we mean changes in the meaning of an expression that take place over an entire language or community of speakers. As opposed to adaptation, historic change is not confined to a particular dialogue. In a given language community, historic semantic change has taken place when the updated meaning is taken as common ground at the community level; i.e., when speakers *begin* dialogues with the new meaning as a mutually understood interpretation of the expression in question.

Distributional semantics seeks to represent the meaning of words based on their co-occurrence with other words. The semantic distance between two words is estimated by the cosine distance between the distributional vectors representing their meaning (Turney and Pantel, 2010). These methods have been used to detect semantic change by comparing representations of the same word across time (Gulordava and Baroni, 2011; Kulkarni et al., 2015). Diachronic word vectors have also been used to test hypotheses about the regularity of semantic change with respect to word frequency and polysemy (Hamilton et al., 2016b), and to detect differences in the mechanisms of semantic change (Hamilton et al., 2016a).

## 2 Methods

This project seeks to test the hypothesis that semantic adaptation is a driver of semantic change. Adaptations achieved through semantic negotiation may persist in future dialogues (among the same participants) and, if speakers introduce the same adaptation in dialogues with others, gain more widespread usage. For this reason, we expect that intra-dialogue semantic adaptation (in aggregate) predicts semantic change at the community level.

The central problem of this project is to find a method of detecting systematic semantic adaptation that is compatible with the diachronic word vectors described by Hamilton et al. (2016b). Let  $\mathbf{w}_t$  be the vector representation of word  $w$  at time period  $t$ ; that is, the vector computed using only contexts for  $w$  that occur in time period  $t$ . To measure semantic adaptation, we additionally compute  $\mathbf{w}_t^b$  and  $\mathbf{w}_t^e$ : the vectors that consider only occurrences of  $w$  at the *beginning* and *end* of the dialogue, respectively.

To achieve this, we propose to split the dialogue before the first use of  $w$  by a second dialogue participant. In other words,  $\mathbf{w}_t^b$  consists of contexts where  $w$  has so far only been used by a single person, and  $\mathbf{w}_t^e$  includes only contexts where  $w$  has been uttered by multiple participants. If a speaker is going to introduce an adaptation in the meaning of  $w$ , it is likely they will do so on their first utterance of the word, since to do otherwise gives positive feedback for the unadapted interpretation. Thus, adapted uses of  $w$  are more likely to occur after the second participant has had a chance to introduce an innovative interpretation of  $w$ .

To compare vectors across time periods and between dialogue partitions, we use orthogonal Procrustes, as described by Hamilton et al. (2016b). In situations with relatively little data and subtle semantic changes, the authors recommend using PPMI vectors with SVD dimensionality reduction.

Experiments will test two hypotheses: First, that semantic adaptation of a word  $w$  predicts historic change i.e.,  $\text{cosdist}(\mathbf{w}_t^b, \mathbf{w}_t^e)$  is correlated with  $\text{cosdist}(\mathbf{w}_t, \mathbf{w}_{t+1})$ . Second, in general the direction of intra-dialogue adaptation indicates the direction of semantic change i.e.,  $\text{cosdist}(\mathbf{w}_t^e, \mathbf{w}_{t+1}) < \text{cosdist}(\mathbf{w}_t^b, \mathbf{w}_{t+1})$ .

## References

- Susan E. Brennan and Herbert H. Clark. 1996. Conceptual Pacts and Lexical Choice in Conversation. *Journal of Experimental Psychology*, 22(6):1482–1493.
- Herbert H. Clark and Edward F. Schaefer. 1989. Contributing to discourse. *Cognitive Science*, 13(2):259–294.
- Kristina Gulordava and Marco Baroni. 2011. A distributional similarity approach to the detection of semantic change in the google books ngram corpus. In *Proceedings of the GEMS 2011 Workshop on GEometrical Models of Natural Language Semantics*, pages 67–71. Association for Computational Linguistics.
- William L Hamilton, Jure Leskovec, and Dan Jurafsky. 2016a. Cultural shift or linguistic drift? comparing two computational measures of semantic change. In *Proceedings of the Conference on Empirical Methods in Natural Language Processing.*, volume 2016, page 2116.
- William L Hamilton, Jure Leskovec, and Dan Jurafsky. 2016b. Diachronic word embeddings reveal statistical laws of semantic change. *ACL*.
- Vivek Kulkarni, Rami Al-Rfou, Bryan Perozzi, and Steven Skiena. 2015. Statistically significant detection of linguistic change. In *Proceedings of the 24th International Conference on World Wide Web*, pages 625–635. International World Wide Web Conferences Steering Committee.
- Staffan Larsson. 2007. A general framework for semantic plasticity and negotiation. In Harry Bunt and E. C. G. Thijsse, editors, *Proceedings of the 7th International Workshop on Computational Semantics (IWCS-7)*, pages 101–117.
- Gregory J Mills and Patrick GT Healey. 2008. Semantic negotiation in dialogue: The mechanisms of alignment. In *Proceedings of the 9th SIGdial Workshop on Discourse and Dialogue*, pages 46–53. Association for Computational Linguistics.
- Peter D Turney and Patrick Pantel. 2010. From frequency to meaning: Vector space models of semantics. *Journal of artificial intelligence research*, 37:141–188.