

How to combine speech and action.

This paper has three parts. First, I discuss the problem of connecting the different conceptual frameworks of natural language pragmatics and natural language semantics, where we encounter the conceptual oppositions of language and action, truth and success, message-based accounts of meaning and compositional semantics. Second, I illustrate this problem with the discussion of an adequate account of the meaning of speech acts and show how to overcome with the opposition between semantics and pragmatics via the definition of an action-theoretic semantics for Discourse Representation Theory (DRT, (Kamp and Reyle 1993)). Finally, I discuss the requirements for and repercussions of the experimental testing of the proposed theory of speech acts on a robot platform.

On the one hand, the vocabulary of theories of natural language pragmatics consists mainly of terms that pertain to non-linguistic entities: e.g. actions, intentions, forces, agents. On the other hand, a theory of natural language semantics that takes into account the structure of sentences in the definition of meaning must involve a vocabulary that is made up from terms that pertain to linguistic entities: e.g. nouns, predicates, sentences. But pragmatics and semantics do not only differ with respect to the type of vocabulary that is employed in the analysis of speech but also with respect to the logical framework of analysis that is employed. While pragmatic approaches to natural language meaning commonly employ propositional logic or message-based accounts of natural language, an adequate approach of natural language semantics that is able to take into account the structure of meaning below the sentence level requires at least a framework of predicate logic.

In order to illustrate this problem, consider John Searle's attempt to deal with these two problems in his classic work on speech acts, where he says the following on the pragmatics of sentences in imperative mood: „If the sentence is imperative, its imperative illocutionary force indicating device (F term) determines that the object referred to by the R term is to do the act specified by the P term, and so on through other examples“ (p. 122, (Searle 1969)), where R stands for the subject and P for the predicate of the imperative. But how does a predicate P specify an act? A few pages later, Searle gives the following explanation: „to know the meaning of a ... predicate expression is to know under what conditions it is true or false of a given object.“ (p. 125,(Searle 1969)). Nothing is said here about how a predicate expression specifies an *action* but only that a predicate specifies conditions under which a predicate is *true* or *false* of a given object. As such, the combination of speech and action in the use of language has not been addressed in a satisfactory manner. Searle's solution to the conceptual problem of relating speech and action consisted in an ontologization of speech acts via the introduction of a third kind of entity besides language and action - so-called illocutionary acts. And while Searle's approach of classifying utterances according to a set of illocutionary acts is still prominent and widely in use, the basic problem of relating speech and action is not solved by the introduction of labels for speech-actions conglomerates (that illocutionary forces are) for which their definition runs into the same problems that speech acts themselves do.

A definition of a speech act that overcomes with these problems must show how truth-conditional semantics and action-theoretic pragmatics combine in the analysis of an utterance as action. This paper proposes an account of speech acts that brings together

speech and action via the definition of a semantics for predicates that incorporates a theory of action as part of the truth-conditional semantics of predicates (Self-Reference). The paper delineates an action-theoretic semantics (based on the BDI-interpretation of CTL\* (Emerson 1990) put forward in (Singh 1994)) for the interpretation of speech acts in the framework of DRT. The connection between semantic representations of natural language and actions is established with the help of temporal anchors, an extension of the concept of anchors for non-temporal discourse referents in DRT proposed by (Kamp 1990; Asher 1993) that preserves the original conception of DRT as a formalism of dynamic semantics that is able to capture a wide range of natural language phenomena. In their design as links between semantic representations of natural language and an action-theoretic model theory, temporal anchors provide a means to transfer information between the linguistic and the action-theoretic level of analysis (e.g. quantification, tense and aspect resp. intentions, obligations).

Finally, I discuss the specific demands on a theory of pragmatics when the theory is tested in a setting of human-robot interaction. The implementation of a pragmatic theory on a robot subtracts the „human magic“ commonly involved in the application of pragmatic theories to the processing of verbal interaction. Consider imperatives. An imperative pertains to future possibilities of action to be undertaken by the hearer, future possibilities which both the hearer - as an epistemically limited agent - and we - as the designers of a formalism that captures the processes that one may suppose to underlie the hearer's interpretation of the imperative - can not specify in advance in full detail. But how should we capture the information conveyed by an imperative if this information is already contained in the interpreter's models against which she evaluates the imperative *before* utterance time? I delineate an answer to this question along the conception of dynamics models ((A. Baltag 1998), (Self-Reference)) that also sheds light on the type of action theory that is necessary for the analysis of natural language meaning.

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