Toward a Dynamic Semantics of "HAVE A COW"

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The Neural Theory Of Language (*NTL*) project underway
at UC Berkeley and ICSI (details of the project can be obtained from http://www.icsi.berkeley.edu/NTL) is based on the premise that known facts on how the brain works can combine with empirically observed linguistic phenomena to provide important constraints in constructing models of language acquisition and use.

In earlier work within the project (Narayanan 97) we built a dynamic model of embodied motion and manipulation words (such as PULL, PUSH, WALK, RUN, STUMBLE, and FALL). A novel feature of the implemented model is an event representation called an "executing schema" or x-schema, an extension of the Petri net formalism (Reisig 85). X-schemas are active structures that tightly couple action and reaction and are highly responsive to changes in both the environment and intentional state. Such properties are precisely those needed for controlling goal-directed behavior in a complex, uncertain and dynamic environment. They also, however, provide a cognitively motivated basis for many semantic distinctions that arise from the highly context-sensitive interaction between lexical and grammatical aspect, nominal semantics and tense. In our model, the semantics of aspect arises from the dynamic binding between verb-specific x-schemas and a "controller" x-schema that captures regularities in the evolution of complex events. Further details can be found in a cogsci paper submission entitled "A Dynamic model of Aspectual Composition" which can be obtained from "http://www.icsi.berkeley.edu/NTL".

The controller x-schema seems to be a general model of event structure and the dynamic model we have implemented supports fine-grained event simulation needed for inference in language understanding. The x-schema model and the controller x-schema have proven useful in modeling interesting aspectual distinctions and we believe that a wide range of semantic phenomena can be accommodated using similar schemata abstracted from sensory-motor primitives. In this paper, we examine the utility of the model to capture certain observations made in the theoretical linguistics literature. Our hypothesis is that a small number of schemata interacting with the controller would capture the relations between "basic predicates" and their extended senses; here we focus on "light predicate" versions of some English verbs.

Jespersen (Jespersen 1933) noticed that, in English and cross-linguistically, certain verbs are polysemous in systematic ways. One such case is the "light predicate" case, where a verb such as HAVE, TAKE, GIVE, which usually has a transitive complement structure, takes as its object complement a nominalized form of an action, or an event denoting predicate. Examples are "take an examination", "have an operation", or "give a kiss". Attempts have been made in the generative tradition to account for the differences between the light predicate headed version (take a walk) and the simple verbal version (walk). These attempts (Grimshaw 88, Kearns 88) have focused on obvious aspectual differences; for instance the light headed version above (take a walk) is clearly perfective, while the verbal version (walk) is not. This has led to the hypothesis that the light headed predicate imposes its aktionsart (inherent aspect) as the aspectual profile of the overall construction. Further attempts at modeling the compositional semantics of these periphrastic constructions (Rosen 89, Rothstein 83) have focused on solving the problem of semantic role assignment from a predicate to its arguments. In this case, the question is which verb in the construction "take a walk" or "have an operation" assigns a semantic role to its subject, and does the nominalized predicate receive a semantic role or not.

Our work is beginning to construct a semantics of light predicates using x-schema based models of events. Work is proceeding in the following directions. First, we can show based purely on linguistic evidence the incorrectness of the hypothesis that light predicates impose their aspectual profile on the entire construc-

tion. Second, on semantic grounds we are extending our earlier work on the controller x-schema by adding the following general x-schemas: a) a source path goal x-schema b) an object transfer x-schema and c) An energy production/consumption/transfer x-schema. As in our earlier work on aspect and metaphor (Narayanan 97), this requires us to work out both the computational details of the individual x-schemas and also how various parts bind to each other. We believe that these additions in conjunction with the existing dynamic simulation framework will go a long way toward modeling the semantics of the light predicate construction.

Currently, our work is at an early stage and we do not promise to have a complete analysis of the light predicate construction in the form of a detailed computational model by the workshop. However, even at this stage, our analysis of not just the light predicate construction but the auxiliary and causative uses of HAVE, GIVE, MAKE, TAKE reveal that x-schema based dynamic model is able to produce the positive results of GB style models but describe accurately a wider range of data. Our presentation at the workshop will concentrate on this range of data and the properties and results of our x-schema based model.

References

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