# Type theoretic approach to information state update in issue based dialogue management

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For several years the research group at our Dialogue Systems Lab has been involved in the development of the information state update approach to the building of dialogue systems and in particular Issue based dialogue management developed in Staffan Larsson's PhD thesis and based on Jonathan Ginzburg's gameboard approach to dialogue, focussing on the notion of questions (or issues) under discussion.

Larsson's computational approach to information state updates involves a large collection of update rules which fire when certain conditions in the information state are met in a regime determined by a general control algorithm. An utterance by a dialogue participant will in general unleash a whole chain of such updates and part of the power of the approach lies in the fact that we can define very general update rules which have small effects on the information state and which are not necessarily linked to any particular form of utterance. It gives us a much finer grain on update rules than thinking in terms of single monolithic updates associated with speaker utterances.

Larsson's formulation of update rules is based on a Prolog implementation and exploits some aspects of Prolog: logic programming variables, backtracking to deal with non determinism, ordering of update actions within an update rule. In this paper we will show how notions of record and record type in type theory can be used to formulate update rules without relying on these aspects of Prolog. This allows us to give an abstract characterisation of update rules independent of programming language which points to a general theory of updates as well as the possibility of implementation in any programming language. The tools we are using can also be used in an account of compositional semantics and this points to the possibility of an integrated formal theory of information state update and compositional semantics.

This work is related to other work on computational approaches to information state update by Johan Bos on the Dipper system and to type theoretical approaches to semantics and dialogue which exploit the notion of context in type theory, e.g. work by Ranta, Ahn et al. and Piwek.