Comparing Action Formalisms: A Preliminary Position Statement

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Here are some fairly miscellaneous thoughts about comparing alternative approaches to Reasoning about Action. (Please forgive me for a few fairly blatant attempts to advertise my own work at the same time.)

(1) When comparing and evaluating formalisms, we need to be careful not to form too strong associations between particular *methodologies* (e.g. deduction and entailment methods, default reasoning techniques) and particular *ontologies*. I can think of a few occasions when this has happened. For example: (i) At least until Murray Shanahan's 1995 paper [8], the ontology of the Event Calculus was irrevocably linked in many researchers' minds with Logic Programming (and in particular with negation-as-failure), and thus dismissed or attacked on "semantic" grounds. (ii) The methodology of using "action languages" (i.e. the Language A, etc. [1]) has become overly associated with the ontology that the original Language A inherited from the Situation Calculus. (Tony Kakas's and my "Language E" paper [2] has shown that, for better or for worse, the methodology can actually be applied in a wider context.) (iii) It seems to be a commonly held belief that "narrative time" ontologies, such as that of the Event Calculus, demand that planning be done using abduction (as opposed to deduction). (I've shown that this is not the case in [6].)

(2) As a community, we should be encouraging work on comparing action formalisms and ontologies, and we should be critical of papers which don't contain adequate comparisons with other work (and especially with work based on different ontologies). There is now a fair body of work exploring how the Event Calculus and the Situation Calculus correspond, so there's really no excuse for lack of comparisons in this case at least. (For formal results, see for example [3], [5], [7], [9] and [2] - the last shows a correspondence between Languages A and E.)

(3) In [2], Tony Kakas and I wrote:

"We believe that the use of, and comparison between, different ontolgies is vital in the study of reasoning about action. Central issues

such as the frame problem, the ramification problem and the qualification problem all take on different flavours when set in different ontological contexts. Comparisons between different approaches can help reveal which aspects of these problems are fundamental, and which are merely the product of a particular method of representation".

I stand by this view. A good example of a (nevertheless interesting) problem which is the product of a particular ontology (rather than being fundamental) is the difficulty of distinguishing between observations and causal rules in the Situation Calculus and in the Language A (i.e. in the context of the Language A, the difficulty in distinguishing the roles of value and effect propositions). Vladimir Lifschitz presented a technically interesting solution to this difficulty in [4], but neither the problem nor the solution translate to other (ontologically different) approaches. We need to be careful to distinguish between this type of issue and more fundamental problems such as dealing with ramifications or continuous change.

(4) We need to keep the role of "action languages" (the Language A, etc.) in perspective. To quote Vladimir Lifschitz [4]:

"Originally, action languages were meant to play an auxiliary role. The primary goal was to represent properties of actions in less specialised formalisms, such as first-order logic and its nonmonotonic extensions, and the idea was to present methods for doing that as translations from action languages".

Well, we shouldn't loose sight of that primary goal. There are many good reasons for using a general purpose logic to represent properties of actions. Perhaps the most important is that it allows us to link in with work on other aspects of common sense reasoning (reasoning about space, shape, beliefs, contexts, etc.).

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