ELECTRONIC NEWSLETTER ON REASONING ABOUT ACTIONS AND CHANGE

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Today

Is change best understood as "caused" by properties of the present state, or by previous change, in some sense of "previous"? Peter Grunwald brought up this point in answer to a question about the difference between his work and that of Lin (1995). This discussion of approaches now engages Lin, Lifschitz, and Sandewall.

Discussions

Discussions about Articles at Commonsense workshop

(Ramifications and sufficient causes)
In connection with Lin's suitcase example, Peter Grünwald asks:
Is the suitcase caused to be open by the mere fact that the switches are up? Shouldn't we rather say that the suitcase is caused to be open if the the switches are put *in the up position?*

To support Lin's view, let me quote from an article by John Searle in the New York Review of Books (1995, Vol. 17, No. 42):

> *In our official theories of causation we typically suppose that all causal relations must be between discrete events ordered sequentially in time. For example, the shooting caused the death of the victim. Certainly, many cause and effect relations are like that, but by no means all. Look around you at the objects in your vicinity and think of the causal explanation of the fact that the table exerts pressure on the rug. This is explained by the force of gravity, but gravity is not an event. Or think of the solidity of the table. It is explained causally by the behavior of the molecules of which the table is composed. But the solidity of the table is not an extra event, it is just a feature of the table.*

- Vladimir

I was delighted and flattered, on the one hand, to learn that one of my previous work had been the focus of discussions in recent Newsletters on Reasoning about Actions and Changes. On the other hand, I was also disappointed and disturbed that much of the remarks about my work were either based on unsubstantiated claims (see below) or plain personal insults such as Peter Grünwald's indignity "'I know what I'm modelling' whereas Lin does not." Hey man, are you really that desperate that you could not find any other way to defend your work?

I don't think this is what this newsletter was set up for, and I'm sure this is definitely not what this community needs.

> *to be misleading. I agree with this, and indeed the observation from our group to his work was that it was more or less a reformulation of what had already been done using occlusion. However, I wonder if there isn't a*

Whoever made this claim, could you please substantiate it? By my understanding of "reformulation", I'm expecting at least something like:

1. A pointer to work on occlusion before IJCAI-95 that discusses examples similar to those in my IJCAI-95 paper.
2. A pointer to work on occlusion before IJCAI-95 that proves results similar to those in my IJCAI-95 paper.
3. A reformulation of my predicate Caused(p,v,s) in the language of occlusion.

- Fangzhen Lin

Peter, Vladimir, and Fangzhen

(The following combines answers to your respective comments to the discussion)

A common feature in much of the recent work is the use of an operator that "enables" change, that is, the operator excepts a feature from the requirement or the preference of persistence. The neutral term exception operator then covers both occlusion (often written as a predicate X), Vladimir's "release" operator, Lin's "Caused" operator, and Peter's "Do" operator, and also e.g. the negation of the "persistent" operator of del Val and Shoham. (An important early reference that articulates the use of such an operator in a general way is Hector Geffner's paper at KR 1989, [c-kr-89-137]).

Anyway, when such logics are used and one is to express that a certain "cause" has a certain "effect", then one has in principle three possibilities:

- The antecedent may refer to the current (new) value of some fluent or combination of fluents.
- The antecedent may refer to the fact that the value of some fluent has changed. For generality, we can view this as a "discontinuity" so that it allows both continuous-valued and discrete-valued fluents. Possibly the antecedent refers to a combination of current value(s) and current change(s) in fluents. (For continuous change, we also have the case where a continuously changing fluent has reached a certain value, that is, a discontinuity of equality).
- The antecedent may refer to the exception operator, possibly in combination with current fluent value(s). This is what happens if "Caused implies Caused".

All of these are instances of what Fangzhen calls "fluent-based causes", that is, causal relationships that only refer to values or changes of fluents, but not to the occurrence of actions.

Peter, you seem to argue that (3) is the right approach, and quote Fangzhen as using (1); Vladimir defends this with the reference to Searle. However, I observe that in his 1995 article, Fangzhen allows both (1) and (3). The general form of causal rules in his formula (16) allows one or more uses of the exception operator in the antecedent. However, example (22) does not use it, apparently in order to assure that the minimization will be computable by Clark completion. Isn't that a problem in your (Peter's) case as well?

Vladimir, I don't see why everything that's called "causation" in natural language has to be handled with the same logical devices. Seconding

Peter's point of view, why can't we use one formalization for causation chains, where one change causes another change, and another formalization for static dependencies? The *causal propagation semantics* that I introduced in my KR 1996 paper [c-kr-96-99] and used for assessments of several approaches to ramification, is exactly a way of formalizing those cases where one change causes another. The kinds of situations that Searle refers to, or the early "dumbbell" example of Ginsberg and Smith represent arguably another class of phenomenona.

For causal propagation of change, there remains the choice between approaches (2) and (3) above: should the rule trigger on the fact that change actually occurred, or on the fact that change was enabled? This is important especially when actions are nondeterministic.

In the Features and fluents tradition, we first used alternative (3) (tech reports only), but then two group members, Tommy Persson and Lennart Staflin argued that (2) was the right way to go. Their paper at ECAI 1990, [c-ecai-90-497], uses (2) for characterizing indirect change. Their paper contains examples from continuous domains, but the formalism is also defined for, and applies equally well to the discrete case. (A revised version of the paper [r-linkoping-90-45] extends the work) In their approach, they wrote rules where the antecedent requires a specific fluent to actually have changed its value, but they also allowed to specify or to restrict the new or the old value.

We were not alone, of course. The paper by del Val and Shoham at IJCAI '93, [c-ijcai-93-732] defines a predicate *persistent*(p, s) that is like the negation of occludes, and an entailment method that (I believe) does chronological minimization of unoccluded change. They mention the need for restrictions on the persistence axioms, but these are quite generous:

> *some further requirements are needed in order to ensure that the extension of persistent at any state depends only on the current and possibly past state of the database, not on future states...*

Also, I imagine that the event calculus is now able to represent these things, and it would be interesting to hear what the history was there (Murray? Rob?).

Finally, in order to answer Vladimir's question

> *Can you please explain this?*

because of my parenthetical remark to Peter, after having agreed with him that the use of the mnemonic "causes" may be misleading,

> ... the observation from our group to [Lin's] work was that it was more or less a reformulation of what had already been done using occlusion

and Fangzhen's question

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First, Fangzhen, if you felt I was being rough, I apologize, it was not my intention. I don't know if it's worthwhile to go so deeply into this, but since you both ask the question let me summarize the background. As several authors are now using operators similar to the family of occlude/ release/ persistent/ caused/ do/, a clarification of history may in fact be of some general interest. The following are the specific contributions of Fangzhen's 1995 paper [c-ijcai-95-1985] according to its abstract:

> *... we argue that normal state constraints that refer only to the truth values of fluents are not strong enough for [specifying the effects of actions using domain constraints], and that a notion of causation needs to be employed explicitly.*

See e.g. the Persson-Staflin paper [c-ecai-90-497]. Several papers in our group during 1988-1993 used a unique concept, "occlusion" or "explanation" of change for several purposes: for imprecise timing of changes within an action with extended duration, for nondeterminism, and also for "our intuition that a discontinuity should have a cause" (Persson/ Staflin). The abstract continues:

> *Technically, we introduce a new ternary predicate... Caused(p, v, s) if the proposition p is caused... to have the truth-value v in the situation s.*

Compare e.g. my article in Journal of Logic and Computation, 1994 [j-jlc-4-581], section 7.2 (misprint corrected):

> *Here $[s,t]p := F$ is an often-useful abbreviation for $(s,t]Xp \wedge [t]p = F$. Informally, it is read as saying that the feature p changes its value to become F some time during the interval $[s,t]$.*

This reduces to *Caused*(p, F, s) if $s = t$. Finally, the abstract says:

> *Using this predicate, we can represent* fluent-triggered *[causal statements]*

Compare the 1990 Persson-Staflin paper, section 5 for some examples.

Besides the material that is mentioned in the abstract, the paper also contains a section 4, which begins

> *The procedure we followed in solving the suitcase problem can be summarized as follows: ...*

and which then also defines a class of theories for which the Clark completion is enough to compute the intended conclusions. The KR'96 paper by Gustafsson and Doherty [c-kr-96-87] shows the striking similarity between this procedure and PMON. The procedure for reducing PMON to a first-order formulation was described by Doherty and Lukaszewicz in their 1994 ICTL paper [c-ictl-94-82], together with similar reductions of all other entailment methods that were assessed in "Features and Fluents" [mb-Sandewall-94]. The generalization of PMON to allowing fluent-based causal rules, is trivial. The reduction also generalizes for rules of types 1 and 2 above. I believe that Clark completion also has trouble with type 3?

We should of course not get enmeshed in priority debates, neither in this Newsletter nor anywhere else. I do feel however that many papers in our area get published with very incomplete accounts of previous and related work. This is unlikely to change because of the constraints that affect us all: limitations on our time, and on the number of pages allowed for each article. No reason to cast stones, therefore, but maybe the section on "related work" in research papers ought not to be our only mechanism for assembling topic-specific surveys and bibliographies, and possibly the present debate forum could serve as a complement. Additional contributions are invited to this account of recent history, therefore.

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