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Today

The discussion between Eugenia Ternovskaia and the authors Marc Denecker, Daniele Theseider Dupré, and Kristof Van Belleghem continues. It has proceeded as follows:

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11.7   Eugenia
17.7   The authors
27.7   Eugenia
 5.8   The authors
20.8   Eugenia
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For those who have not followed the discussion in detail, an important part of it (especially in the latter messages) has concerned the relationship between causal rules and state constraints, which provide two different perspectives on ramification. One specific issue has been whether a causal rule involving more than one successor state is to be interpreted as a state constraint. – The most recent contribution to the discussion follows below.

In the debate about the ontologis of time, Erik Sandewall today answers to Jixin Ma's contribution from 31.7 on that topic.

ETAI Publications

Discussion about received articles

An Inductive Definition Approach to Ramifications

by Marc Denecker, Daniele Theseider Dupré, and Kristof Van Belleghem

Comment from: **Eugenia Ternovskaia**

Dear Marc, Daniele and Kristof,

Thank you for answering my questions and clarifying the motivation for your work.

A few words regarding our discussion about proof system versus model-theoretical approach. I was asking, without criticizing, about performing reasoning in your system on the object level, i.e., embedding your approach in a proof system. From your answer I understood that you consider both OLP and some logical representations as candidates for formalizing and performing reasoning. This answer is satisfactory, and it would be interesting to learn more about OLP from your papers.

> I do not understand neither this comment nor the "Counter" example. The rules imply a state constraint relating any two consecutive states. This constraint is perfectly valid.

> *It seems there is just a misunderstanding about terminology here. We use the term "state constraint" to mean a relation between fluents within any one state, not between different states (see also the definition in the paper). As such the term corresponds to for example Reiter's and Shanahan's notions of state constraint and Thielscher's and Lifschitz's notions of domain constraint (to name just a few). We were not aware of a different use of these terms in the literature.*

This is true, I have not seen this wider notion of a state constraint in the literature either. However, Chitta Baral and Ray Reiter used this term in a conversation recently. I do not see a reason why this wider notion could not be used as well.

Even if we choose not to extend the notion of a state constraint, it's hard for me to see in what way your observation would imply any interesting theoretical consequences. It seems obvious that a causal rule imply universal statements about situations (states) involving as many states as there are those mentioned in the causal rule. Your "counter" example only shows that there are indirect effects of actions depending on two consecutive states, not just one. It's hard to disagree. All causal rules of this king will imply universal statements about two consecutive states, not about just one, of course.

Regarding Definition 1, I do not remember whether you define what a literal is. Maybe I just missed it. When I was reading the definition, I did not assume that $\{t\}$ and $\{f\}$ can be literals. In the definition, you say "and body B a nonempty set of positive and negative literals of D". I understood that you take positive and negative literals of D, leaving $\{t\}$ and $\{f\}$ out because they are *not* literals. This contradicted to the discussion below. Of course I figured out what you mean, and then wrote to you thinking that a little rewording would help the reader.

Regards,
Eugenia

Debates

Ontologies for time

From: Erik Sandewall

Dear Jixin,

In ENRAC 27.7 (98059) I wrote and you answered:

> ... the timepoint domain will then be agent-specific. It will also be local to each scenario, ... In fact, it even becomes necessary to revise the timepoint domain each time a *query* is asked...

> *First of all, it is important to note that, by taking both intervals and points as primitive, the time domain is general enough for various scenarios, ... All these four cases are allowed by the same time theory, without the need to revise the time domain at all.*

One of the cases you mention is where two intervals Meet in direct succession; one is where the first interval Meets a point which in turn Meets a second interval; in the two remaining cases one or the other interval includes that point. - I am afraid there's a misunderstanding here, since I was referring to the domain used *in each of the interpretations*. For each particular interpretation, it must certainly be determined whether or not there is a point between the two intervals. Therefore, different scenarios will sometimes differ with respect to their domains for the type of "point" (and maybe also for the type "interval"?) if one insists on dealing with dividing instant situations by using domains where for certain clocktimes there is no corresponding (time)point. Sometimes, different models for the same scenario will also differ in that respect.

Now to the examples. I will take for granted that we talk about timepoints and intervals that are related along the lines of Pat's core theory, only with the adjustment that intervals are not entirely determined by their endpoints: there can be up to four intervals for each pair of endpoints, because you allow these intervals to be either open or closed at each end. (The interval will then be defined as closed if there exists a point beginning resp. ending it, otherwise it's open).

You refer to an example by Galton where a Green light and a Red light both switch On at the same time. This is somewhat counterintuitive - I would have thought that one goes Off when the other one goes On - but that doesn't matter. You propose the following scenario description for the case where we have decided to consider the Green light to be On at the dividing instant, and we have decided to keep that open for the Red light:

```
Holds(GreenOff, I2)
Holds(GreenOn, P)
Holds(GreenOn, J2)
Holds(RedOff, I1)
Holds(RedOn, J1)
Meets(I2,P)
Meets(P,J2)
Meets(I1,J1)
I1 + J1 = I2 + P + J2
```

Actually, these axioms do not indicate that the two lights switch at the same time. Let's assume that such a statement has been added, otherwise the point with the example is lost. Now, in every model for these axioms it must be determined whether P is included in I1 or in J1. (Or, if you disagree, what would a model be like where P is neither included in I1 nor in J1?) Suppose P is included in I1. Then, as long as timepoints and intervals are related along the lines of Pat's core theory, you can't avoid the conclusion that the interval I1 ends with P, and hence that the Red light is Off at the dividing point. Similarly, if P is included in I2, it must be that I2 begins with P, and that the Red light is On at the dividing point. Therefore, *in each of the models* there is the kind of choice that you called "arbitrary" with respect to whether the Red light is to be considered On or Off.

My two examples come out in similar ways. For example A, you write:

Yeah, for the modelling of the throwing of a ball, it requires that there exists a point referring to the apex. However, the fact that Jim turned

> *the switch does not necessarily imply that there must not be any such point, especially if one insists that "at a moment (point?) when it (the ball) reaches the top of its trajectory, he (Jim) turns the switch".*

But if (in a particular model) such a point exists for the clocktime where Jim turned the switch, then it must be determined (in that same model) whether the switch is on or off at that point, and you have your Dividing Instant Problem back again.

For example B, you write:

> *I don't agree with the claim that "a point both exists and does not exist at the clocktime whent he winner finishes his last cone and the bell rings". Again, I think this claim was reached by means of confusing two cases, that is, the case that an interval "Meets" a point, and the case that an interval was "Finished-by" a point.*

Not really. If you wish to avoid a dividing instant situation by using a punctuated time domain (for each of the models, so that there is no dividing instant problem in any of the models), then you *must exclude* models where that timepoint is present. It can't be present explicitly, and it can't be present implicitly by being the ending or beginning of an interval, because in all of those cases you end up assigning the truthvalue that you considered arbitrary. The only way of complying is to have two successive open intervals without any point between them. (That is, an interval not ending in a point, and a subsequent Meeting interval not beginning in a point). However, this in turn contradicts the assumption that the Bell rings, since it was assumed the Bell rings at (time)points. Therefore, the only possible models are those where the Bell rings without the cones having been finished, and you obtain the conclusion I indicated.

The bottom line is, therefore, that it is futile to try to impose noncommitment for dividing instants on the level of the models and by using nonstandard time domains such as "punctuated time". In those cases where we wish to express that we don't know or don't care whether a certain proposition is true or false at a point of change, it's sufficient to use the multiple models approach while admitting "standard" time (integers or reals, by preference). Then we don't need any theory of time at all besides high-school or (at most) college math.

All of this presumes of course standard two-valued logic, where models can only assign the truth-value true or false. You may obtain another perspective by going to e.g. three-valued logic, where *everything* can be undetermined besides true or false. But, as H.C. Andersen once said, that is another story.

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