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Protocols from Continued Workshop Discussions:

Workshop on Logics of Commonsense

Queen Mary and Westfield College, January 7-9, 1998

Edited by: Erik Sandewall
Linköping University, Sweden

The **Fourth Symposium on Logical Formalizations of Commonsense Reasoning**, or **Commonsense 98** for short, took place from the 7th to the 9th of January, 1998. The customary discussion of articles **at** the workshop was continued in the ENRAC Newsletter, and its first part was documented in the February *News Journal*. The discussion continued into March and is documented here.

The full papers can be obtained from ENRAC's webpage structure, which contains links to the current state of the discussion and to the author's home pages as well as links to the actual articles.

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Protocol of continued on-line discussion during March, 1998
about the following research article from FCS-98:

Peter Grünwald

Ramifications and sufficient causes

C1-12. **Murray Shanahan** (12.3)

Erik,

> *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?).*

Now that the heat of the debate has died down a little, I would like to give a belated response.

The issue of ramifications and indirect effects is dealt with quite thoroughly in my book Solving the Frame Problem, especially in the context of the event calculus. (Incidentally, the book also deals extensively with the situation calculus, so it's not just an axe-grind for a particular formalism.) A large number of standard benchmark scenarios are discussed. These include the following.

- The dead or alive scenario
- The walking turkey shoot
- The stuffy room scenario
- The chess board scenario (Reiter)
- The "safe from baby" scenario and
- the "wet in lake" scenario (Giunchiglia & Lifschitz)

I believe the treatment of these scenarios covers all the issues in the current debate. (One version of Thielscher's circuit example raises some interesting issues not covered in the book. But this example can be dealt with too.)

In particular, the event calculus formalism presented in the book incorporates a Releases predicate, much like Vladimir's releases predicate and Erik's occlusion, which exempts a fluent from the common sense law of inertia. (The intellectual debt is duly acknowledged in the book.) It also permits state constraints, such as

$$HoldsAt(Alive, t) \text{ if } HoldsAt(Walking, t)$$

as well as more "causal" constraints such as,

$Initiates(a, Wet, t)$ if $Initiates(a, InLake, t)$.

If anyone has a scenario they think the book's formalism can't handle I'd like to hear from them.

I do feel however that many papers in our area get published with very incomplete accounts of previous and related work.

I second that. I didn't devote years of my research time, as well as a lot of sweat and tears to writing that book for no-one to read it. (I know Erik sometimes feels the same way.) On my part, in the book, I tried very hard to give credit to others wherever appropriate, and to build on other's work rather than starting from scratch wherever I could.

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.

I don't agree. We are all guilty of this to some degree, of course, and I tend to be generous in actual refereeing. But deep down I feel that an article that doesn't take scholarship seriously doesn't deserve to get published, in the same way that it wouldn't deserve to get published if it contained mathematical errors.

Murray

C1-13. **Pat Hayes** (12.3)

Vladimir Lifschitz, in reply to Erik Sandewall (ENRAC 27.2 (98022)), asks the following:

First, if $s = t$ then your informal reading turns into "p changes its value to become F some time during the interval $[t, t]$." How can p change its value during an interval consisting of one time instant?

Consider a flash of lightning at night, during which a room is instantaneously illuminated (p) for a single moment. The relevant predicate changes its value twice during such an instant, if the instant is considered to be like a point (having no duration), which seems quite plausible. Even if you insist on making the flash into an interval by separating the times of its beginning and ending, these times are both the temporal locations of instantaneous changes in the illumination-predicate.

In fact, one can make a case that *any* change must involve instantanous changes. Consider the classical example of two adjacent intervals meeting at timepoint t (which in my favorite temporal logic is identical to the interval $[t, t]$), and a light being switched on at t, so that p - being illuminated - becomes true at that timepoint. One might object that such an apparently instantaneous change is in fact always really a continuous one (the electricity begins to flow, the filament becomes hot and begins to glow, etc.) and therefore occupies an non-instantaneous interval. But then consider the beginning point s of *that* interval, and consider the property q of an illumination-change happening. The transition from not-q to q is now instantaneous at s. Clearly, the same strategy is going to work no matter how much you turn up the temporal magnification: there will always be a first point of the relevant interval, and *something* will be different there from the point immediately preceding.

For what its worth, by the way, this is one of the few places where quantum physics seems to agree with naive intuition :-)

Pat Hayes

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Protocol of continued on-line discussion during March, 1998
about the following research article from FCS-98:

Eyal Amir

Point-Sensitive Circumscription

Presented at the workshop by Tom Costello

Q1. **Erik Sandewall**

I have questions about your section 6, "Applying Point-Sensitive Circumscription to Theories of Action", which I can not make sense of. You first review the formulation of PCM (Prototypical Chronological Minimization) in pointwise circumscription, and then write (p. 71):

> *We do not claim that Point-Sensitive Circumscription can formalize the entire $\mathcal{K}$-**IA** ontological class, but that it can take you farther than Pointwise circumscription can.*

Let me briefly review the relevant aspect of Features and fluents, in order to put what follows into context. The $\mathcal{K}$-**IA** ontological class allows for scenarios with nondeterministic actions, actions with extended duration in time and internal structure, and all combinations of prediction and postdiction. It does not model causality or other forms of ramification, nor concurrency, etc.

For this $\mathcal{K}$-**IA** class, we have studied a number of *entailment methods*, each of which can then be reexpressed in e.g. pointwise circumscription. PCM is one of those entailment methods. Each of them is defined in terms of preference criteria or other selection criteria on models, and it is these criteria that may be translated e.g. to circumscription as a way of proceeding towards an implementation. For each entailment method, there is also an assessment of range of applicability. This assessment is model-theoretic, and is independent of the choice of implementation method.

In this framework it is perfectly reasonable, as you do, to evaluate a variant of circumscription with respect to whether or not it is capable of expressing a particular entailment method, or even a collection of them. This makes much more sense than analyzing circumscription variants directly in terms of test examples, since then so much depends on the choice of axiomatization.

Though I agree with your methodology up to that point, I do not understand the concrete case where it is applied. You only discuss how PCM is rendered in variants of circumscription, but Doherty has already shown how to express PCM in pointwise circumscription. If your variant of circumscription is able to handle more examples correctly within the range of $\mathcal{K}$-**IA**, it could therefore only be because it were an inaccurate rendering of PCM.

Also, although the range of applicability of PCM is only a limited part of $\mathcal{K}$-**IA**, there are other entailment methods such as PMON which are correct for $\mathcal{K}$-**IA**, and which can also be expressed in pointwise circumscription following Doherty. This makes it even more strange how point-sensitive circumscription can do something that pointwise circumscription can not, with respect to the $\mathcal{K}$-**IA** class.

You also discuss a simple case of ramification using the duality between the *dead* and *alive* properties. This of course is not within $\mathcal{K}$-**IA**, as you also observe. However, there are certainly known methods that handle such simple ramifications (as well somewhat less trivial ones) correctly and that have been expressed or re-expressed using pointwise circumscription.

Could you help me understand your contribution in these respects?

A1. **Eyal Amir** (2.3)

Dear Erik. Thank you much for your insightful comments. You write

> *In this framework it is perfectly reasonable, as you do, to evaluate a variant of circumscription with respect to whether or not it is capable of expressing a particular entailment method, or even a collection of them. ...*
>
> *Though I agree with your methodology up to that point, I do not understand the concrete case where it is applied. You only discuss how PCM is rendered in variants of circumscription, but Doherty has already shown how to express PCM in pointwise circumscription. If your variant of circumscription is able to handle more examples correctly within the range of* $\mathcal{K}$-**IA**, *it could therefore only be because it were an inaccurate rendering of PCM.*

[For the reader: PCM is defined roughly as follows (see [s-Gabbay-94-999] for more details): Interpretations $I \prec_{pcm} I'$ iff $M = M'$ (the objects are the same) and there is t_0 s.t.

1. for all $t < t_0$, $R(t) = R'(t)$ (the fluents are identical in I and I' before t_0) and
2. $breakset(I, t_0) \subset breakset(I', t_0)$ (the fluent value changes from $t_0 - 1$ to t_0 in I are a subset of the appropriate changes in I').

Then the set of models for PCM is

$$S_{pcm}(T) = Min(\prec_{pcm}, models(T))$$

Pointwise Circumscription (I shall abbreviate it here Pt-Circ) is a special case of Point-Sensitive Circumscription (abbreviated here Pt-Sens), and so PCM can be expressed in Pt-Sens the same way [c-ictl-94-82] shows with Pt-Circ. However, Doherty and Lukaszewicz showed that Pt-Circ expresses PCM only for the ontological class $\mathcal{K}$p-**IAex**, in which no observations later than time $t = 0$ are allowed. The example I give in the paper shows that Pt-Sens may be able to express PCM outside $\mathcal{K}$p-**IA** (notice that the example I give falls within $\mathcal{K}$-**IA**, as the "ramification" is accounted for by domain constraints (observations for time later than 0)). I did not prove a higher lower-bound, though. I just showed cases outside $\mathcal{K}$p-**IA** where Pt-Circ fails and Pt-Sens succeeds.

You then write

> *Also, although the range of applicability of PCM is only a limited part of $\mathcal{K}$-**IA**, there are other entailment methods such as PMON which are correct for $\mathcal{K}$-**IA**, and which can also be expressed in pointwise circumscription following Doherty. This makes it even more strange how point-sensitive circumscription can do something that pointwise circumscription can not, with respect to the $\mathcal{K}$-**IA** class.*

My claim was that we may be able to avoid filtering (the way [c-ictl-94-82] does) in grasping $\mathcal{K}$-**IA**. I did not prove that either. Future work?...

> *You also discuss a simple case of ramification using the duality between the* dead *and* alive *properties. This of course is not within $\mathcal{K}$-**IA**, as you also observe. However, there are certainly known methods that handle such simple ramifications (as well somewhat less trivial ones) correctly and that have been expressed or re-expressed using pointwise circumscription.*

Although the simple example I gave is within $\mathcal{K}$-**IA**, I support the claim that Pt-Sens can treat some forms of ramification (a first hint at that was made in a paper of mine in NRAC'97). I am not aware of previous expressions of ramifications using Pt-Circ and will be happy to get some pointers.

Eyal

References:

[c-ictl-94-82] Patrick Doherty and Witold Lukaszewicz. *Circumscribing Features and Fluents.* Proc. International Conference on Temporal Logic, 1994, pp. 82-100.

[s-Gabbay-94-999] Erik Sandewall and Yoav Shoham. *Nonmonotonic Temporal Reasoning.* In: Dov M. Gabbay, C.J. Hogger, and J.A. Robinson (ed): Handbook of Logic in Artificial Intelligence and Logic Programming. Volume 4: Epistemic and Temporal Reasoning. Oxford University Press.

C1-1. **Patrick Doherty** (8.3)

Hi Eyal,

A few comments regarding your paper and then a few regarding your comments to Erik. First, your paper:

First off, I think your notion of Pt-Sens circumscription is an interesting technical result, but wonder about its widespread applicability (see comments below). The "counter-intuitive example" (your description) you provide as a reason for proposing Pt-Sens circumscription would appear to be more counter-intuitive in the way the policy is set up rather than in the result. The reason for introducing pointwise circumscription in the first place **is** so that one can vary **parts** of an extension while fixing other parts. To introduce a policy where you vary the whole extension of the predicate you are minimizing strikes me as being a bit extreme. But, I suppose one could find more intuitive "counter-intuitive" examples to prove your case, which do not violate one's sense of proper use of pointwise circumscription (if there is such a thing!)

You also state in section 7 that

> *pointwise circumscription is sufficient if we restrict ourselves to deterministic actions and to cases in which there are no domain constraints.*

Well, the $\mathcal{K}$-**IA** class deals with non-deterministic actions just fine and in the case of PMON, or its extension PMON(RC) discussed below, where ramification can be dealt with using a combination of domain and dependency constraints, syntactic characterizations for both can be defined using pointwise circumscription. Although it is computationally more feasible to choose a different type of circumscription. You can check my ecai94 paper [c-ecai-94-401] or the paper by Gustafsson and myself in kr96 [c-kr-96-87]. In fact, I think you attended the ijcai97 workshop where I demonstrated PMON(RC).

In conclusion, I enjoyed the first part of the paper, but I'd think the second part regarding applications to logics of action and change needs some more work (By the way, I have only read your workshop draft, so you may have fixed things since.)

Now some comments about your and Erik's interaction:

> *Pointwise Circumscription (I shall abbreviate it here Pt-Circ) is a special case of Point-Sensitive Circumscription (abbreviated here Pt-Sens), and so PCM can be expressed in Pt-Sens the same way* [c-ictl-94-82] *shows with Pt-Circ. However, Doherty and Lukaszewicz showed that Pt-Circ expresses PCM only for the ontological class* $\mathcal{K}$p-**IAex**, *in which no observations later than time* t_0 *are allowed.*

The point is that PCM is limited to the class $\mathcal{K}$p-**IAex**, and Pt-Circ was used to provide a syntactic characterization of PCM's minimization policy, not that Pt-Circ is inherently unable to represent classes which subsume $\mathcal{K}$p-**IAex**.

> *My claim was that we may be able to avoid filtering (the way* [c-ictl-94-82] *does) in grasping* $\mathcal{K}$-**IA**.

I did not prove that either. Future work?...

Why would you want to avoid filtering? And, if there is a legitimate reason, I would imagine you'd want to replace pointwise circumscription with a more computationally efficient policy than a generalization of generalized pointwise circumscription which is what Pt-Sens appears to be.

> *You also discuss a simple case of ramification using the duality between the* dead *and* alive *properties. This of course is not within* $\mathcal{K}$-**IA**, *as you also observe. However, there are certainly known methods that handle such simple ramifications (as well somewhat less trivial ones) correctly and that have been expressed or re-expressed using pointwise circumscription.*
>
> > Although the simple example I gave is within $\mathcal{K}$-**IA**, I support the claim that Pt-Sens can treat some forms of ramification (a first hint at that was made in a paper of mine in NRAC'97). I am not aware of previous expressions of ramifications using Pt-Circ and will be happy to get some pointers.

In the KR96 paper by Gustafsson and myself [c-kr-96-87], we introduce a straightforward technique to extend PMON, which is assessed correct for the $\mathcal{K}$-**IA** class, so that it deals with a broad class of problems associated with ramification. This logic PMON(RC) subsumes $\mathcal{K}$-**IA**. The minimization policy is practically the same as PMON and can trivially be defined using pointwise circumscription, although we use standard predicate circumscription (in fact predicate completion). In fact, we model both the stuffy room example from Winslett and the alive/walking example in the paper. There are many more examples that you can test using the VITAL tool which I demonstrated at IJCAI97.

Regards,

Patrick Doherty

References:

[c-ecai-94-401] Patrick Doherty. *Reasoning about Action and Change using Occlusion.* Proc. European Conference on Artificial Intelligence, 1994, pp. 401-405.

[c-ictl-94-82] Patrick Doherty and Witold Lukaszewicz. *Circumscribing Features and Fluents.* Proc. International Conference on Temporal Logic, 1994, pp. 82-100.

[c-kr-96-87] Joakim Gustafsson and Patrick Doherty. *Embracing Occlusion in Specifying the Indirect Effects of Actions.* Proc. International Conf on Knowledge Representation and Reasoning, 1996, pp. 87-98.