Refutation of open-universe causal reasoning

Abstract: The proposition and axiom as tested are *not* tautologous. This does not "validate an intuitive and familiar set of principles about subjunctive conditionals and the relation of causal influence". This also does not support "an important class of implicit generative models that can plausibly be treated as genuine causal models" or "enable reasoning beyond the propositional level". The conjecture of open-universe causal reasoning forms a *non* tautologous fragment of the universal logic VŁ4.

We assume the method and apparatus of Meth8/VŁ4 with Tautology as the designated proof value, **F** as contradiction, N as truthity (non-contingency), and C as falsity (contingency). The 16-valued truth table is row-major and horizontal, or repeating fragments of 128-tables, sometimes with table counts, for more variables. (See ersatz-systems.com.)

LET ~ Not, ¬ ; + Or, ∨, ∪, ⊔ ; - Not Or; & And, ∧, ∩, ⊓, ·; \ Not And;
> Imply, greater than, →, ⇒, ↦, ≻, ⊃, ↠, ⇝ ; < Not Imply, less than, ∈, ≺, ⊂, ⊬, ⊭, ↞, ≲ ;
= Equivalent, ≡, :=, ⇔, ↔, ≜, ≈, ≃ ; @ Not Equivalent, ≠;
% possibility, for one or some, ∃, ◊, M; # necessity, for every or all, ∀, □, L;
(z=z) T as tautology, ⊤, ordinal 3; (z@z) **F** as contradiction, Ø, Null, ⊥, zero;
(%z>#z) N as non-contingency, Δ, ordinal 1; (%z<#z) C as contingency, ▽, ordinal 2;
~(y < x) (x ≤ y), (x ⊆ y), (x ⊑ y); (A=B) (A~B).
Note for clarity, we usually distribute quantifiers onto each designated variable.

From: Ibeling, D.; Icard, T. (2019). On open-universe causal reasoning. arxiv.org/pdf/1907.02170.pdf

Abstract We extend two kinds of causal models, structural equation models and simulation models, to infinite variable spaces. This enables a semantics for conditionals founded on a calculus of intervention, and axiomatization of causal reasoning for rich, expressive generative models—including those in which a causal representation exists only implicitly—in an open-universe setting. Further, we show that under suitable restrictions the two kinds of models are equivalent, perhaps surprisingly as their axiomatizations differ substantially in the general case. We give a series of complete axiomatizations in which the open universe nature of the setting is seen to be essential.

2.1 Structural Equation Models

Definition 3: … X ⇝ Y (read X influences Y)

Proposition 1. Let $M \in M_{local}$ and $X, Y \in \chi$. If M |= X⇝ Y and t(Y) > t(X)+1, there is a variable X′ such that M |= X⇝ X′ and M |= X′ ⇝Y. (2.1.1)

LET p, q, r, s: t, X, X', Y

((q>s)&((p&s)>((p&q)+(%s>#s))))>(%r>((q>r)&(r>s))) ;
TTTT **FF**TT TTNN TTTT (2.1.2)

3.2 Axiomatizations

F/D. [α]¬β ↔ ¬[α]β (3.2.5.1)

LET p, q: α, β.

(p&~q)=(~p&q) ; T**FF**T T**FF**T T**FF**T T**FF**T (3.2.5.2)

> **4 Conclusion** We have identified two equivalent classes of models—one declarative, one procedural—formalizing the notion of an open-universe causal model. Both classes validate an intuitive and familiar set of principles about subjunctive conditionals and the relation of causal influence. This highlights an important class of implicit generative models that can plausibly be treated as genuine causal models, on a par with (an infinitary generalization of computable, recursive) structural equation models. ... One of the advantages of open-universe models is precisely that they enable reasoning beyond the propositional level. …

The proposition and axiom (Eqs. 2.1.2 and 3.2.5.2) as tested are *not* tautologous. This does not "validate an intuitive and familiar set of principles about subjunctive conditionals and the relation of causal influence". This also does not support "an important class of implicit generative models that can plausibly be treated as genuine causal models" or "enable reasoning beyond the propositional level".