Negation in event semantics with real and imaginary events

**Introduction:** Davidson 1967 proposed to model action verbs, such as *walk*, as predicates with an implicit semantic argument interpreted as the event described by the verb, in addition to the traditional ones (e.g., the walker). The principal motivation for this move was its ability to treat adverbial modifications in the same fashion as adjectival ones, namely in a conjunctive way which immediately accounts for the inferences translated as \( \exists e. v(e) \land adv(e) \Rightarrow \exists e. v(e) \). While Davidson conceived events as having a spatio-temporal extension, his proposal has been subsequently extended to states (*being happy*) and I am following Peterson 1997 in allowing events to be more abstract objects like the absence (or negation) of other events. Indeed, 'negative events' are not as different to traditional events as one could think at first glance: they too seem to be modified by adverbs (*Eva didn’t sleep for two days*), referred to anaphorically (*This is worrying*), involved in causal statements (*So, Eva is weak*) and they can often be expressed with a positive paraphrase (*Eva stayed awake*).

**The puzzle:** Accounting for negated sentences in event semantics is notoriously difficult. A sentence such as *It is not raining* is usually represented as the paraphrase *there is no raining event*. In logical terms, this means that the negation scopes over the event quantifier: \( \neg \exists e. \text{rain}(e) \). More generally, event quantifiers are often considered to always take the lowest possible scope (Champollion, 2015); ensuring that the grammar implements this constraint in a compositional way can be troublesome and has been dubbed the *event quantification problem* (*EQP*) (Winter and Zwarts, 2011). One potential weakness of such a paraphrase is that it doesn’t allow a causal statement of the form *The dog is playing outside because it is not raining* to be represented as a relation between events since a not-raining event is not made available; additionally, it doesn’t mix well with mereological treatments of distributivity as noted by Schwarzschild 2014. To these ends, one may use the kind of *negative events* proposed by Peterson 1997 and Higginbotham 2009; they have, however, not been fully formalised. In Krifka 1989, the definition of negation introduces semantic objects called *maximal events* (*MXE*), the sums (in the mereological sense) of all events occurring during a certain interval of time. These, however, cannot play the role of negative events. Indeed, there is always exactly one MXE for any given period of time and so, the MXE considered for *Today it neither rained, nor did Eva solve an equation* would subsume both negative elements and could not be decomposed into a not-raining part and an Eva-not solving-the-equation part. Krifka’s negation also isn’t involutive: it doesn’t make *Eva didn’t not reach the top* logically equivalent to *Eva reached the top*. My goal is to give a compositional account of negation in a Davidsonian framework that (i) makes such negative objects available and (ii) exhibits reasonable logical properties. In particular, it should be involutive and an equivalence similar to ‘it is not raining if and only if there is no raining event’ should still hold.

**Solution:** My proposal is to represent negation with a function \( \text{Neg} \) that turns a set of events \( P \) into an event \( \text{Neg}(P) \), interpreted as the non-\( P \) event. The EQP does not arise as the event quantification does scope over the negation. I also introduce a primitive distinction between *real* and *imaginary* events: in contrast with the former, the latter are only potentialities that never become reality. Then, the logic of negation can be captured with a single axiom, namely that the non-\( P \) event is real if and only if all \( P \) events are imaginary: if it didn’t rain, i.e. \( \text{Neg}(\lambda e. \text{rain}(e)) \) is real, then no raining event occurred, i.e. every \( e \) such that \( \text{rain}(e) \) is imaginary, and *vice versa*. This same axiom suffices to prove the equivalence of *not not P* and \( P \). Also, in contrast with Krifka’s account, the \( \text{Neg}(P) \) event is dependent on the predicate \( P \) being negated and is thus suitable for entering in causal statements of the form *cause(\text{Neg}(P), e)*.