The Linguistic Expression of Causation

Ad Neeleman and Hans van de Koot (UCL)

> Causal relations are imposed by humans on the input from the world, and the linguist's task is to understand what it is about language that enables speakers to use it to describe their causal perception. (Reinhart 2000: 38)

1. Introduction

The main claim of this paper is that causation, as commonly understood in the philosophical and psychological literature, is not fully expressed in natural language predicates. The standard scheme for causation neither matches the syntactic structure projected by causative predicates nor their lexical semantics. What a predicate *can* do is emulate causation by other means, albeit imperfectly.

As a point of departure, we should provide a definition of causation. Any theory of causation (in the general sense, rather than the narrow linguistic sense) adopts the clauses in (1a) and (1b) below. In addition, a dependency must hold between the causing event and the caused event, in that the caused event takes place as a consequence of the causing event. Perhaps the best-known formulation of this dependency is due to Lewis's (1973) counterfactual theory of causation, which can be summarized as in (1c).

(1) a. Causation is a relation between a two events: a causing event and a caused event.
b. Causation has a temporal dimension: the causing event must precede the caused event.
c. Causation is counterfactual: if the causing event had not occurred, the caused event would not have occurred either.[1]

There are numerous complications with the exact formulation of the dependency between caused event and causing event. We will mostly ignore these, as the clauses in (1a) and (1b) are sufficient to develop our argument.

It is important to realize that theories of causation are not theories about the world, but theories about human psychology and in particular about how humans understand the world. Consider a simple example. Suppose that a window breaks as a result of John swinging a hammer against it. Humans have the intuition that John's swinging a hammer caused the window to break, but that it is absurd to claim that John's mother meeting John's father caused the window to break. However, if John's mother had not met John's father, the window would not have broken either. In other words, the definition of causation in (1c) cannot make a distinction between the two claims under discussion, even though *we* clearly regard one as true and the other as false. This disconnect between the definition in (1c) and human intuitions about causation is widely regarded as a problem for counterfactual theories, demonstrating that theories of causation are concerned with our understanding of the world and not with the world itself. If the theory of causation were intended as a theory of physical reality, human intuitions would be discarded as irrelevant and possibly misleading. It seems reasonable, then, to construe causation as one of the principles involved in the construction of

[1] A less intuitive but more adequate formulation of the counterfactual condition would read "If the caused event did not occur, then the causing event could not have occurred either".

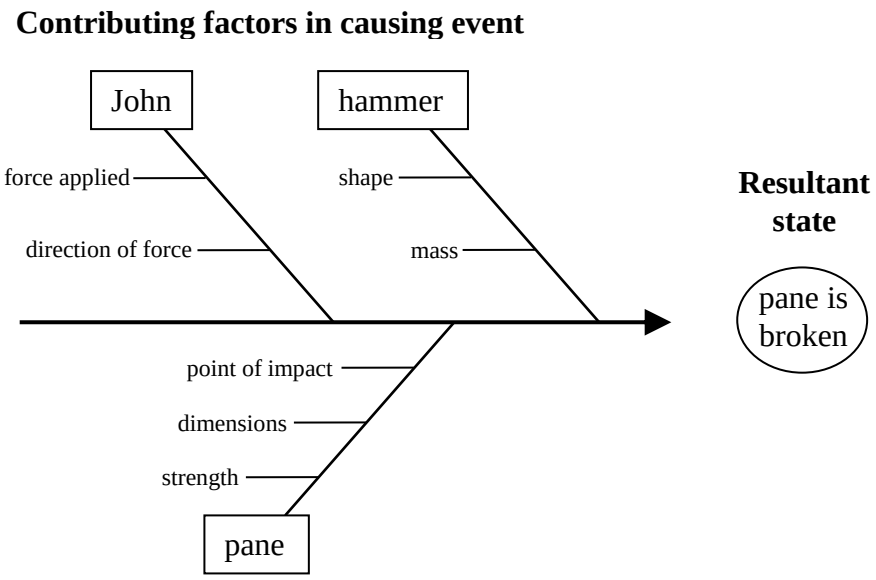
our mental model of reality (see Johnson-Laird 1983 and subsequent work for discussion of mental models).

It is equally important to realise that causation is not a linguistic notion. That is, language can be used to talk about causation, but causation exists as a psychological tool for understanding the world independently of language. One argument for this comes from the observation that causal reasoning can be spared in aphasic patients. Varley (2002) demonstrates this using the performance of two patients with severe grammatical impairments on a series of reasoning tasks (see also Varley & Siegal 2002). Both patients showed profound disruptions of propositional language. Nonetheless, one patient showed well preserved performance on all tasks; the second patient was capable of sophisticated causal reasoning, but had difficulties on tasks requiring hypothesis generation and testing.

A further argument to the same effect can be based on the behavior of pre-linguistic children in experiments involving animations of objects moving across a surface. Such experiments show that six-month old babies can distinguish (some) causally sound interactions between objects from impossible interactions (see Leslie 1984, Leslie and Keeble 1987, and Oakes 1994, among many others). This implies that at least *some* causal relations are recognized before language is acquired.

By their very nature, mental models contain a lot of very fine-grained information. It is therefore trivially true that no single linguistic expression can convey the richness of a mental model. A lot of information must be left out. In order to demonstrate this, let us return to the situation in which John swings his arm holding a hammer, and the hammer hits a glass pane that shatters upon impact. A little reflection will reveal that the causing event is quite complex. Many factors enter into the equation, including the speed with which Johns swings the hammer, the mass of the hammer, the strength of the glass and the point of impact on the surface of the glass pane. Whether or not the glass will break can only be predicted accurately once the values for all these factors are known. We summarize the situation with the following fishbone diagram:

(2)



A speaker who utters the sentence *John broke the window* may have a mental model that corresponds to (2), but the sentence itself does evidently not convey all the information accessible to the speaker. This raises the question to what extent information about causal relations is represented in linguistic expressions. What information is left out? Our suggestion is that the cause relation is not a primitive of the linguistic system, but that language emulates

causation by using two other primitives. More concretely, we suggest that what causative verbs encode are (i) the notion of crucial contributing factor (henceforth CCF) and (ii) the culmination of an event in an end state (here the pane being broken). Although many predicates combine (i) and (ii), (i) is also found in a subset of predicates that are stative (and therefore non-causative). Moreover, (ii) is expressed in the absence of (i) in various unaccusative verbs.

There is ample evidence that verbs may express states resulting from events and factor (ii) is therefore hardly controversial. However, it may be helpful to explain in a bit more detail what we mean by factor (i). Given the complexity of the mental model (and the complexity of reality), a speaker must decide which factor is essential in a causal relation (the CCF) and which factors fall in a *ceteris paribus* category. For example, suppose that several burglars use a hammer in an attempt to break a particularly strong window, and that only the most muscular of them – John – succeeds. This situation can be described by saying that John broke the window, where John is presented as the crucial contributory factor. It would be odd to say that the hammer broke the window. On the other hand, if John was alone and tried to break the window first by using a brick, then by using a piece of timber and finally by using a hammer, succeeding only in the last attempt, then the situation may be described quite naturally by saying that the hammer broke the window. In doing so, the choice of instrument is presented as the crucial contributory factor.

In summary, we propose that the linguistic representation of causative verbs (or more specifically their lexical semantics) can be characterized as in (3a). On this characterization, a sentence like *The hammer broke the window* can be paraphrased as "The hammer was the crucial contributing factor in the event that culminated in the window being broken". This proposal is to be contrasted with theories that claim that natural language predicates may transparently express causation. Such theories entail that verbs like *break* are associated with the structure in (3b) at some level of representation, so that the example at hand can be paraphrased as "Some event involving the hammer was the cause of the window becoming broken".

(3) a. $\lambda y\, \lambda x\, [[_e\, x\, [_s \ldots\, y \ldots]]\, \&\, x = \text{CCF}]$

b. $\lambda y\, \lambda x\, [_e\, \text{CAUSE}([_{e1} \ldots\, x \ldots], [_{e2} \ldots [_s \ldots\, y \ldots]])]$

The opposition between (3a) and (3b) is reminiscent of the distinction between theories that treat causal predicates as bi-eventive (see Parsons 1990 and Pylkkänen 2008) and theories that postulate a CAUSE theta-role (see Doron 1999 and Reinhart 2000, 2003). Indeed, we side with the latter, but it is important to make clear what this choice entails. There is no disagreement regarding the claim that causation as a tool for understanding the world is a relation between events. The question under discussion is whether this relation is fully realized in the semantics of causative verbs: we claim, following suggestions by Reinhart, that this is not the case. Given that causes must be events, it is somewhat misleading to use the label CAUSE – or the feature [+c] – for the external θ-role of verbs like *break*. Indeed, it is clear from Reinhart's work that for her the feature [+c] is a convenient shorthand not to be confused with the notion of causing event. In particular, [+c] arguments may be also be specified as [+m] and clearly events cannot have a mental state. We replace [+c] arguments by CCFs precisely to avoid any such confusion.

Note the limited scope of our hypothesis. We are claiming that natural language predicates encode only certain aspects of causation. We are *not* claiming that it is impossible to use language to speak about causation or about causing events. For example, it is possible to enrich a sentence like *John broke the window* with a modifier indicating what it was that John did that resulted in the window being broken. The above scenario, for example, may be

described by saying that *John broke the window by swinging a hammer against it*. It seems reasonable to classify the event expressed by the adjunct as a causing event. On the theory in (3b), the modifying clause could be interpreted as specifying e_1 (giving rise to formula like "... & e_1 = [PRO swing a hammer against it]"). On our proposal, the modifier would explicitly *introduce* the modifying event, giving rise to a formula like "... & CAUSING-EVENT(*e*, [PRO swing a hammer against it]). This type of semantics is on a par with that usually assigned to temporal and locational modifiers. In fact, there is some evidence that this may be a better analysis than one based on specification of a pre-existing causing event in the verb's lexical semantics. *By*-phrases of the relevant type can be added to unaccusative verbs that appear to lack a causative interpretation in their absence. There is no sense of causation in (4a), for example, but there clearly is in (4b):[2]

(4) a. Little Orson grew into a big man.
b. Little Orson grew into a big man by eating John McCann's Steel Cut Irish Oatmeal.

To repeat, we admit that it is possible to give information about the causing event, but deny that the causing event is represented in the semantics of the verb.

One striking observation in support of the representation in (3a) is that cross-linguistically causative structures allow, and sometimes require, a surface realization in which the external argument of the causative predicate refers to an individual rather than an event. That is to say, while causation is a relationship between something that happens and another thing that happens, natural language predicates often represent it as a relationship between an individual and something that happens. In fact, we are not aware of any causative predicate in any language that *requires* its external argument to denote an event. This is easily understood if causative predicates have the semantic representation in (3a), as a CCF can either be an individual or an event, but it is unexpected on the analysis in (3b).

This is not to say that the representation in (3b) could not be encoded in the lexical semantics of a causative predicate. This is indeed the general line of analysis in much work on argument structure. For example, Hale & Keyser (1993), Ramchand (2008) and Pylkkänen (2008) all argue that there is a functional head that contains the causing event as part of its semantics. The external argument is construed as one of the participants of this event. On our view, such an approach, while certainly feasible, requires independent evidence for the assumption that the causing event is linguistically encoded. It is not enough to assume that causative predicates fully represent causation. Rather what is required is empirical confirmation that the causing event is present in the linguistic representation.

[2] Throughout this paper we assume that unaccusatives do not have a causative interpretation, simply because there is no evidence to suggest that they do. As Reinhart (2000) discusses at some length, *The door opened* does not mean "the door opened itself". Related to this interpretive fact, there are well-known differences between unaccusatives and passives. Moreover, omitted objects often have a restricted interpretation (*John drinks* means that John drinks alcohol, *John smokes* means that he smokes tobacco, etc.). No similar saturation effect is ever found with the suppressed external argument of an unaccusative verb. Of course, anything that happens in the world will have some cause, including the events described by unaccusative verbs. But if this is enough to classify a verb as causative, it leads to the conclusion that every verb describing an event is causative.

We do of course know that Chierchia (1989), Levin and Rappaport (1995) and Reinhart (2000, 2003), argue that unaccusatives are derived from causatives by argument suppression. There are clear advantages to an analysis along these lines: it explains why in causative-unaccusative pairs it is often the unaccusative verb that is morphologically marked. However, an analysis along these lines does not necessarily imply that the causative semantics of the base form is inherited by the output of suppression. In the case at hand, the suppression operation could take the form of deletion, a possibility that is in fact entertained in Reinhart 2000: 42.

It is not so easy to imagine what kind of evidence could support the presence of a causing event 'hidden' in the lexical semantics of a causal predicate, as such hidden events are unlikely to be accessible to linguistic tests. However, on closer inspection the literature does appear to contain strong evidence in favour of the linguistic encoding of causing events. There is very general agreement that causative constructions come in mono-clausal and a bi-clausal variants, exemplified in English by *John killed Bill* and *John caused Bill to die*. Of these, the first is taken to express 'direct' causation, while the second is taken to express 'indirect' causation. Direct causation can be defined as a causative relation between contiguous events: no third event is allowed to intervene. Such a condition cannot be imposed if causative verbs have a semantic representation as in (3a). Given that (3a) lacks a causing event, it is not possible to require that this causing event be contiguous to anything. Consequently, our proposal can only be upheld if the claim that simple causatives express direct causation is wrong. By contrast, if the literature is correct and a condition of direct causation holds of simple causatives, this would only be compatible with the representation in (3b), which does contain a causing event.

We therefore begin by exploring, in section 2, the evidence supporting the claim that mono-clausal causatives express direct causation.

2. The paradox of direct causation

It is widely accepted that, at least in English, simplex predicates expressing causation must express *direct* causation (see, among many others, Fodor 1970, Katz 1970, Bittner 1999, and Wolff 2003). The claim is nicely illustrated by Katz's Wild West story about a sheriff whose six-shooter is faultily repaired by the local gunsmith. As a result, his weapon jams at a critical moment and the sheriff is gunned down. Katz concludes that "clearly, the gunsmith caused the death of the sheriff, but equally clearly, the gunsmith did not kill him". In other words, there is causal chain from the gunsmith's faulty repair to the sheriff dying, but there is reluctance in most native speakers to construe the gunsmith's faulty repair as the immediate cause of that event.

The intuition appears clear, at least at first sight, and meshes well with the observation in Fodor 1970 that the causing event is not accessible for separate adverbial modification. Fodor's observation is based on the contrast in (5), to which we return below. What the data in (5) are meant to show is that while complex predicates tolerate separate temporal modification of subevents, simplex predicates do not.

(5) a. John caused Bill to die on Sunday by stabbing him on Saturday.
b. *John killed Bill on Sunday by stabbing him on Saturday.

Many researchers have concluded from these facts that causative verbs in English encode direct causation. Direct causation can be defined in a variety of ways, but subtleties aside it differs from regular causation in requiring a very tight relation between the causing event and the caused event/resultant state. In particular, there cannot be a causal chain leading from the causing event to an intermediate event that in turn gives rise to the caused event. As a consequence, the causing event and the caused event are temporally contiguous (demonstrated by the contrast in (5)) and no intervening agents can exist (demonstrated by Katz's Wild West story).

As explained in the introduction, these generalizations are important. If it is the case that simplex causative verbs are subject to special conditions that mention the causing event, then that event must be represented in the semantics of those verbs in the first place. Our

reply to this challenge is to argue that the generalizations that are used to support the claim that simplex causatives are direct causatives are incorrect.

To begin with, it is certainly possible to use simplex causative verbs to describe situations in which the supposed causing event is separated from the caused event by intermediate events. Take a headline like "NHS negligence killed my brother". This headline would be appropriate for a story that relates how sloppiness in ordering supplies led to the unavailability of certain antibiotics, which in turn meant that a patient who had developed complications after a kidney transplant could not be treated and died. In the same vein, Katz's story above can be summarized as "The gunsmith's negligence killed the sheriff." Clearly, it would be a stretch to characterize either of these situations as involving direct causation, as one cannot reasonably speak of temporal contiguity between the causing event and the caused event: the two are separated by a potentially complex chain of intervening events.

Although the standard claim is that simplex causatives cannot be used to describe situations of indirect causation, the fact of the matter is that such usage is possible with many of these verbs. We give some representative examples below.[3]

(6) a. A kind word with the manager will no doubt open the door.
you speak to manager → manager speaks to doorman → doorman opens door

b. Opening bus lanes to motorcycles will redden the streets of London with cyclists' blood.
opening of bus lanes → increase of accidents → cyclists' blood on London streets

c. Launch of new iPhone contracts is expected to enlarge T-Mobile's UK market share.
availability of contract → people enter contract → improved market share

d. A slip of the lip can sink a ship.
loose talk → information obtained by spy → spy informs foreign navy → submarine torpedoes ship

e. Anglican Church says overpopulation may break eighth commandment.
overpopulation → poverty → theft → theft breaks eighth commandment

f. A large fleet of fast-charging cars will melt the grid.
many electric cars on roads → many cars charging simultaneously → high electricity demand → heating of electric cables → melting of the grid

All of these examples are compatible with situations that involve a non-trivial chain of causation, as indicated. In fact, in most cases, this is the only way to make sense of the example. For instance, there is no sense in which the slip of the lip mentioned in (6d) could directly cause a ship to sink. Moreover, the situation described by the sentence in (6d) does not require temporal contiguity. Each subevent in the scenario described by the example may be temporally separated from other subevents. For example, the slip of the lip may take place in May, whereas the resulting attack on the convoy may take place in September. Similar observations can be made about the other examples.

Although the data above are problematic for the view that simplex causatives express direct causation, they are fully compatible with the hypothesis that causative predicates do not encode a causing event, but instead identify a CCF. By its very nature, the notion of CCF is highly flexible and we therefore expect that the event with which it is associated can be separated from the resultant state by an arbitrary number of intermediate events as long as the

[3] Example (6d) is the title of a 1943 Duke Ellington song. Example (6e) was taken from http://news.mongabay.com/2010/0608-hance_anglican.html on 21/9/2010. Example (6f) was taken from http://www.lowtechmagazine.com/2009/03/fast-charging-electric-cars-off-peak-grid.html on 21/9/2010.

various aspects of these events can be considered as belonging to the *ceteris paribus* category.

What about the argument for direct causation that could be based on Fodor's (1970) observation that causative verbs are impenetrable for adverbial modification? Our take on Fodor's generalization is as follows. The example in (5a) is grammatical because *on Sunday* modifies the caused event, while *on Saturday* modifies the causing event. There is no contradiction between these temporal specifications; they meet the condition that the causing event precede the caused event. However, it is important to note that even in a complex causative construction, the logic of causation puts restriction on the scope of temporal modifiers. Consider the example in (7), which is ambiguous: *on Sunday* can modify *die* or the macro-event *cause to die*. Crucially, the second of these readings is unavailable in (5a), because it would imply that the causing event (the stabbing) precedes the macro-event (cause to die). This is clearly incoherent.

(7) John caused Bill to die on Sunday.

The ungrammaticality of (5b) can be explained in exactly the same way as the absence of the wide-scope reading of *on Sunday* in (5a). Because (5b) is mono-clausal, *on Sunday* can only be construed as modifying the macro-event. This entails that the causing event must also have happened on Sunday. However, according to the information given in the adjunct, the causing event took place on Saturday. This is a contradiction.

Crucially, the ungrammaticality of (5b) can*not* be attributed to the fact that a separate temporal specification is given for the causing event. Such a separate temporal specification is admissible as long as it falls *within* the temporal specification of the macro event. For example, in (8), the macro event takes place on Sunday, which allows for the causing event to take place in the morning, with the caused event potentially taking place much later that same day. This possibility is brought out by the continuation in parenthesis.

(8) John killed Bill on Sunday by stabbing him in the gut just after breakfast. (He died at five past ten, after having been rushed to hospital and having been operated on for several hours.)

In this respect there is no difference with complex causatives, which also allow a matrix adverbial to specify an interval that includes the causing event (as well as the caused event):[4]

(9) Last Sunday John caused Bill to die in the afternoon by stabbing him in the gut just after breakfast.

In conclusion, the only difference between simplex and complex causatives is that the latter syntactically project a constituent that expresses the caused event. As a consequence, complex causatives allow temporal modification of the caused event, while simplex causatives do not. However, there is no requirement of temporal contiguity between the causing event and the caused event in either simplex or complex causatives. The only requirement for which there is any evidence is that a temporal interval specified for the macro event must include both the causing event and the caused event.

This conclusion supports our earlier rejection of the claim that simplex causatives express direct causation. But rejecting direct causation seems to go against the intuition that

[4] The analysis of temporal modification in causative environments proposed here carried over to the other types of modifier discussed in Fodor 1970.

an account of Katz's example above must refer to some notion of direct involvement. In the sentence *The gunsmith killed the sheriff*, the gunsmith seems to be directly involved in the bringing about of the sheriff's death; this is not true of *The gunsmith caused the sheriff to die* (or of *The gunsmith's negligence killed the sheriff*). In other words, at this point we have seen that there is no evidence for the notion of direct causation, but we are left without an account of the 'Katz effect'.

Our proposal is that this effect comes about not so much because of a condition of direct causation but rather because natural language encodes accountability for certain states of affairs. As a rule, the referent of a DP specified as [+m] is held accountable for the action expressed by the verb if and only if it is the CCF argument of that verb. Our proposal is clearly similar in spirit to Reinhart's analysis of AGENTS as [+c,+m] arguments (see Reinhart 2000, 2003), with the proviso that we replace the feature [+c] with the notion of CCF. An agent, on Reinhart's view, is a cause with a mental state, and having a mind is a precondition for being held accountable for anything.

In the next section, we develop this suggestion in more detail.

3. Explaining the Katz effect

Let us insert an anachronistic element in Katz's Wild West story. Following the demise of the sheriff, the gunsmith visits the local psychoanalyst because he is struggling with feelings of intense guilt. Indeed, although no-one has accused him of anything, he maintains that he killed the sheriff, something the psychoanalyst tries to get to the bottom of. So, a typical exchange might include the following:

(10) Gunsmith: I killed the sheriff.
Psychoanalyst: You can't be sure you killed the sheriff. It may have been a *Fehlleistung*. But then again you could also have made an honest mistake when you repaired the gun.

What does this exchange show? To begin with, it shows that the Katz effect cannot be absolute. If it were, the conversation in (10) would be incoherent: the gunsmith would knowingly utter a falsity. In fact, there is no reason to think that the gunsmith and his analyst disagree about what actually happened. Rather, what they are discussing is whether the gunsmith can be held responsible for what happened. The gunsmith feels that he is responsible; the psychoanalyst is not so sure. This is a first indication that the notion of accountability rather than the notion of direct causation is relevant to the Katz example.

Why then do we normally reject the sentence *The gunsmith killed the sheriff* as a description of Katz's wild west story? Not because the story implies indirect causation or an extended chain of causation between the gunsmith's actions and the sheriff's death, but rather because the story does not invite us to hold the gunsmith responsible for the sheriff's death. Indeed, the Katz effect disappears if we slightly change the story.

Suppose there the gunsmith has held a long-standing grudge against the sheriff and has been pondering how to bring about his death without drawing attention to himself. One day the sheriff brings his gun in for servicing and the gunsmith sees his chance. Knowing that the sheriff always gets involved in gunfights with unsavoury characters, he decides to sabotage his gun. Sure enough, the next day there is another gunfight, and as a result of the gunsmith's action, the sheriff's weapon jams at a critical moment and he is gunned down. Given this scenario, it would be perfectly natural to answer the question *Who killed the sheriff?* by saying *The gunsmith killed the sheriff*. As in our earlier adjustment of Katz's story, this cannot be due to the scenario involving direct causation: the causal chain of events

is identical to that in Katz's original story. The crucial difference is that in our adjusted story the gunsmith has the intention of causing the sheriff's death, and intentionality implies accountability.

These observations are sufficient to demonstrate that the Katz effect cannot be used as an argument for direct causation (and thus indirectly for the presence of a causing event). However, there is more to be said about restrictions on accountability and the Katz effects they give rise to. In particular, there is evidence to support a distinction between at least three types of causative predicate with respect to the degree of 'direct involvement' they require of the external argument. This three-way distinction can be understood in terms of conditions on [+m] CCF arguments, but must remain unexplained in theories that account for Katz effects in terms of direct causation.

The weakest relation between an external [+m] argument and a resultant state is found with complex causatives. In any relevant variant of Katz's Wild West story it is possible to maintain (11).

(11) The gunsmith caused the sheriff to die.

Recall that the referent of a DP specified as [+m] is held accountable for the action expressed by the verb if and only if it is the CCF argument of that verb. In (11) *the gunsmith* is the external argument of *cause*, but not an argument of *die*. Therefore, the accountability of the individual it denotes is limited to the causation event – it excludes its resultant state. In other words, although it is undeniably true that the gunsmith did something that contributed to a chain of events that culminated in the sheriff's death, the example in (11) does not imply that gunsmith is accountable for the resultant state itself. Therefore, this example is compatible with situations in which the gunsmith is merely negligent but not guilty of manslaughter or murder.

As we have already seen, the relation between an external [+m] argument and a resultant state is stricter in a simplex causative like (12).

(12) The gunsmith killed the sheriff.

For this example to be felicitous, the gunsmith must be accountable for the entire macro-event, which of course includes its resultant state. This is because the subject is the external argument of *kill*, which describes the macro-event. The consequence is that there is some sense of direct involvement in the coming about of the resultant state, but by no means anything resembling direct causation, as in principle the chain of events leading to the resultant state is unbounded. Therefore, capturing the Katz effect associated with examples like (12) requires that we are more precise about the circumstances under which we attribute accountability to a person. We propose that there is a locality effect in the computation of accountability. A person cannot be held responsible for a resultant state if there is an intervening agent in the mental model whose decisions are interpreted as instrumental in bringing about that resultant state. This idea can be stated as in (13).

(13) *Local Accountability Assignment (LAA)*
Consider a mental model that contains a causal chain of events e_1, e_2, ..., e_r, where e_r is a resultant state. If an individual that is a participant in e_n is held accountable for e_r, then no individual that is a participant in e_{n+m}, where e_{n+m} intervenes between e_n and e_r, can be held accountable for e_r.

The condition in (13) does not forbid ascription of accountability 'across' participants of an intervening event in a causal chain, as long such participants fall into the ceteris paribus category. That is, their actions must be taken for granted, and cannot be interpreted as what distinguishes the situation under scrutiny from comparable situations. This explains why the gunsmith in (10) can maintain that he killed the sheriff: he takes the actions of the outlaws (as well as those of the sheriff himself) as given, and therefore he can select himself as the accountable individual without violating LAA. The same is a precondition for using (12) as a description of the scenario in which the gunsmith intentionally sabotages the sheriff's six-shooter.

We can demonstrate the effects of LAA by further modifying this second scenario so that the shooter is presented as someone deciding on the sheriff's fate. As we will see, this modification triggers a radical shift in our judgment of the felicity of (12). Suppose that the unsavoury character in the crucial gun fight – let's call him Bronco – notices that the sheriff's gun doesn't work. The unwritten code of the Wild West militates against shooting an unarmed opponent. Bronco therefore hesitates what to do next, but, being the unsavoury character that he is, he does in the end take aim and shoots the sheriff. On this modification of the story, the question *Who killed the sheriff?* cannot be answered by saying *The gunsmith killed the sheriff*, even though the gunsmith had every intention of causing the sheriff's death and his actions were instrumental in bringing about this resultant state. This is because (12) ascribes accountability to the gunsmith, while in the mental model there is a individual – Bronco – who participates in an event closer to the resultant state and whose actions cannot be interpreted as falling in the ceteris paribus category. This closer agent therefore blocks ascription of accountability to the gunsmith. As a consequence, (12) does not fit the context (although (11) would, of course).

There is a third class of causative predicate that imposes a much greater degree of personal involvement than we have seen so far. An example is *shoot*:

(14) The gunsmith shot the sheriff

The sentence in (14) does not fit with any of the scenarios discussed so far. Even if the gunsmith intended for the sheriff to die as a result of his sabotage, it is not true that he shot the sheriff. Why should there be this difference between *kill* and *shoot*? We conjecture that this contrast originates in the fact that *shoot* specifies an instrument (a gun), whereas *kill* does not. The presence of an instrument in the lexical semantics of a verb is relevant because instruments are associated with a user and a resultant state brought about through the use of the instrument.

An immediate consequence of association with a user is that an instrument requires intentionality. Given that intentionality in turn implies accountability, an instrument must be linked to a [+m] CCF. This explains why there is a contrast in acceptability between (15a), on the one hand, and (15b) and (15c) on the other.

(15) a. The bandit killed the sheriff with a colt 45.
b. *The bus killed the pedestrian with its nearside front wheel.
c. *The sheriff died with a colt 45.

In (15a), the subject is a [+m] CCF, as required. In (15b), it is a CCF, but no mental state can be ascribed to it, while in (15c) the subject can be specified as [+m] but is not a CCF (not even if the sheriff committed suicide).

But intentionality is not enough to license the presence of an instrument in a sentence. A further condition must be met. In the prototypical case, an instrument is an object

manipulated by the user to bring about a physical change through direct contact. Linguistic instruments can diverge from the prototypical case in certain respects, but nevertheless they are construed as associated with the actions of the user and the immediate effects that these actions have. That is to say, if the instrument is specified in the mental model as used in event e_n, it must be interpreted as being manipulated by a [+m] CCF participant in that event and as instrumental in bringing about the subsequent event e_{n+1}. We can demonstrate this by, once again, considering the scenario in which the gunsmith sabotaged the sheriff's gun with the aim of bringing about his death. Let us assume that the means of sabotage were a few grains of sand, which the gunsmith deliberately inserted into the gun's firing mechanism. As before, the gun jams at the critical moment and the sheriff loses his life. We can describe the relevant causal sequence as in (16a). Crucially, the entire causal sequence is part of the gunsmith's intentions. Therefore, if instruments only required intentionality, we should be able to replace *x* in the *The gunsmith killed the sheriff with x* by a wide range of expressions. However, whenever the instrument is interpreted as separated from the gunsmith's actions because of the state it brings about, the resulting example can no longer be matched to the scenario.

(16) a. The gunsmith inserts sand into the gun → the gun jams → the bandit gets an opportunity to fire his colt 45 → the sheriff dies
b. The gunsmith killed the sheriff with a few grains of sand.
c. *The gunsmith killed the sheriff with a colt 45.

The example in (16b) is acceptable because the gunsmith does indeed manipulate the sand and the insertion of the sand is understood as causing the next event in the causal chain, namely the jamming of the gun. By contrast, (16c) is not a proper description of the scenario we have sketched, even though the sheriff was killed with a colt 45 and the gunsmith took actions to bring this about. The reason for this is that the resultant state of the use of the colt 45 is the death of the sheriff, but the gunsmith is not the person wielding that revolver.

What these examples show is that the addition to a causative predicate of an instrument taken to bring about its resultant state gives rise to a very strong form of the Katz effect: the agent must be interpreted as manipulating the object used to bring about that state. Thus, the flexibility in the length of the causal chain normally allowed by a verb like *kill* is reduced in (16c) to something coming very close to direct causation. The example can only be used in contexts in which the gunsmith himself manipulates the gun used to kill the sheriff.

Simplex causatives that specify an instrument in their lexical semantics require that this instrument brings about the resultant state expressed by that verb. In other words, there is a causative verb that means 'kill with a gun' (namely *shoot*), but there could not be a causative verb meaning 'kill with a few grains of sand' (on the intended reading). We speculate that the reason for this restriction lies in a condition that the interpretation of lexical predicates be self-reliant (possibly as a consequence of lexical integrity). This condition is meant to forbid reference to elements not mentioned in the semantic representation of the predicate.

An instrument realized as a syntactic adjunct can be associated with a subsequent event in the mental model. However, given the condition introduced above, this is not allowed for instruments specified in a verb's lexical semantics: they must find a subsequent event or state in the lexical semantic representation itself. It will be clear that the only component that qualifies as such is the resultant state encoded by the verb. But given that instruments must be manipulated by the [+m] CCF to which they are linked, all simplex causatives that imply the use of an instrument will of necessity trigger a sense of direct involvement of the external argument. Therefore, *The gunsmith shot the sheriff* has

restrictions on its use that come very close to those of *The gunsmith killed the sheriff with a colt 45*. The sentence cannot be used in any of the elaborate scenarios explored in this section.

Of course, *shoot* does not only differ from *kill* in implying the use of an instrument, but also in the weaker sense of implying intentionality. It is easy to show, however, that this cannot be the factor responsible for the very strict Katz effect observed with *shoot*. The verb *murder* is like *kill* in not implying the use of an instrument, but like *shoot* in implying intentionality. The example in (17) can be used to describe all of the scenarios sketched above, except those in which the gunsmith did not have the intention to cause the sheriff's death. This indicates that intentionality by itself cannot be what lies behind the restrictions observed in the use of *shoot*.

(17) The gunsmith murdered the sheriff

The contrast between *kill* and *murder* on the one hand and *shoot* on the other is part of a wider pattern. Other verbs that encode the use of an instrument also trigger the strong version of the Katz effect. Some examples are given in (18) below. We leave it to the reader to check that these indeed cannot be used as a description of longer causal chains.

(18) a. John peeled the apple.
b. The angry farmer gunned down the burglar.
c. Antonio blindfolded the prisoner.
d. Suzanne combed her daughter's hair.

We do not want to suggest that the encoding of instruments is the only factor imposing restrictions on the causal chain that can be described by a predicate. Further research will have to establish what other aspects of lexical semantics enter into the equation. However, the data discussed above do warrant the conclusion that there are at least three types of causal predicate, namely complex causal predicates, simplex causal predicates like *kill* and simplex causal predicates like *shoot*. It will be clear that the distinction between direct and indirect causation is not enough to capture the full set of data. In fact, when we look at actual restrictions on the use of causative predicates to describe a variety of scenarios, the notion of direct causation does not seem to play a role at all. If it did, we would expect similar effects in sentences with a [-m] CCF, contrary to fact. Rather, the restrictions we have observed seem to be associated with the notion of accountability and the stricter notion of intentionality implied by the use of an instrument. The Katz effects, then, do not provide evidence for the presence of a causing event in the linguistics representation of causative predicates.

4. CCFs with non-causative predicates

In the preceding sections we have explored the claim that simplex causatives express direct causation, as this claim could potentially provide evidence for the presence of causing events in the lexical semantics of such causatives. We have seen that lexical causatives are not in general subject to a condition of direct causation, and that the data that have been used to argue for direct causation can in fact be explained, and explained better, in terms of accountability and intentionality.

This brings us to a second part of our argument, namely that the components that make up the lexical semantic representation of causative predicates are motivated independently. That is, these same components are found – in different constellations – in the lexical semantics of verbs that are not causative. This is perhaps not a very surprising claim

for resultant states that express the accumulation of an event. Presumably, unaccusative verbs like *die* or *grow up* have a lexical semantic representation as in (19). These verbs encode an event that culminates in a state, but they have no apparent causative interpretation and do not express a CCF.

(19) $\lambda y\ [_e\ [_s\ \ldots\ y\ \ldots]]$

It would be more surprising if the notion of CCF had a wider scope than just causative predicates, especially in view of the fact that CCFs are our replacement of CAUSE arguments. Indeed, although CCFs are not associated with a causing event in the linguistic representation, we have so far assumed that they represent an aspect of a causing event in the mental model. In the remainder of this section, we show that this characterization of CCFs is insufficiently general. It is true that causing events can be associated with a CCF, but there is at least one further type of eventuality in the mental model that can motivate the presence of a CCF in lexical semantics.

In section 1 we defined causation as in (1), repeated here as (20).

(20) a. Causation is a relation between a two events: a causing event and a caused event.
b. Causation has a temporal dimension: the causing event must precede the caused event.
c. Causation is counterfactual: if the causing event had not occurred, the caused event would not have occurred either.

However, there is a second relation that bears a certain similarity to causation, but lacks its temporal dimension. We will refer to this relation as 'maintenance'. It can be defined as in (21).

(21) a. Maintenance is a relation between two eventualities: a maintaining state or event and a maintained state.
b. Maintenance lacks a temporal dimension: the maintaining state or event must be contemporaneous with the maintained state.
c. Maintenance is counterfactual: if the maintaining state or event were absent, the maintained state would not exist either.

Maintenance is a relation in which the continuation of a particular state of affairs is dependent on the continuation of an activity or a second state of affairs. To get a sense of what we mean by this, consider the examples in (22).

(22) a. The wall protects the city.
b. John's uncle supports him financially.
c. The beam carries the wall above it.
d. The sheriff upholds the law.

The typical paraphrase of these sentences uses the verb *keep*. For example, if the wall protects the city, then the wall keeps the city safe. What this means is that the presence of a wall around the city maintains the safety of the city. In other words, the latter – maintained – state is dependent on the existence of the former – maintaining – state. Notice that the maintaining eventuality need not be construed as a state. For example, if the cavalry protects

the city, presumably it does so by riding around on horses. In this case, the maintaining eventuality is an activity.

Let us emphasize that maintenance cannot be construed as a sub-case of causation. This is because the definition in (20) requires precedence of the causing event, while maintenance requires coincidence of the maintaining state. It does not make sense to say that the presence of the wall precedes the safety of the city in (22a). Rather, the maintained state is present as long as the maintaining state is present. So, whereas causation is a relation between something that happens and something else that happens, nothing happens in relations of maintenance.

Because of this, maintenance verbs meet a criterion of homogeneity that is not met by verbs of causation. It is true of every subinterval of *the wall protects the city* that the wall protects the city, but it is not true of every subinterval of *the gunsmith killed the sheriff* that the gunsmith killed the sheriff. In other words, verbs of maintenance, but not verbs of causation, can be classified as Davidsonian states in the sense of Maienborn (2003, 2005, 2008). One straightforward test that distinguishes Davidsonian states from events is whether or not a subsequent statement of the type 'This happened when…' is felicitous. Davidsonian states are incompatible with such anaphoric reference. As expected, the test distinguishes between verbs of causation and verbs of maintenance. All verbs of causation allow this continuation; no verb of maintenance does.

(23) a. The gunsmith killed the sheriff. This happened when Mary was in town.
b. The wall protected the city. #This happened during the Middle Ages.

Verbs of maintenance are sometimes called 'stative causers' (see Kratzer's 2000 and Pylkkänen 2000). This is an unfortunate choice of terminology, as on standard assumptions causation and maintenance are different relations. Maintenance can only be considered a type of causation if aspects of the definition of causation normally taken to be crucial are removed. However, the two relationships do share a notion of dependence between eventualities: just like the caused event is dependent on the causing event, the maintained state is dependent on the maintaining state or activity (this is probably what Kratzer has in mind when she calls the relevant class of verbs causative). In view of this, we suggest that verbs of causation and verbs of maintenance both have a resultant state as part of their lexical semantic characterization. However, where this resultant state is interpreted as a culmination in the case of causative verbs, it is interpreted as coexisting with and dependent on another state or activity in the case of verbs of maintenance. If so, verbs of maintenance provide a second example of an embedded state found in a non-causative predicate.

There is, of course, an alternative way of interpreting the similarity. Our argument is based on the assumption that we must distinguish two relations in the mental model: causation and maintenance. They share certain characteristics, which in turn implies that their linguistic expressions are similar in certain respects (one of which is the presence of a resultant state). But it could be that what we consider two similar but distinct relations should in fact be unified. On this alternative view, the mental model would employ only a single relationship – dependence between eventualities – that would allow either an eventive or a stative implementation. Dependence would then be defined along the following lines:

(24) a. Dependence is a relation between two eventualities: an independently existing eventuality and a dependent eventuality.
b. Dependence is counterfactual: if the independently existing eventuality were absent, the dependent eventuality would not exist either.

But this cannot work. Generalizing over causation and maintenance implies that the temporal specification of these relationships must be removed (as precedence and overlap are distinct). However, this makes it impossible to guarantee that, where dependence is interpreted as causation, the causing event precedes the caused event. The definition in (24) would also allow situations in which the causing event follows the caused event. This is clearly the wrong result: in our thinking about the world a cause precedes its effect. It would also make it impossible to guarantee coincidence of maintaining and maintained eventuality, again against the way we think about the world.

If we are correct in distinguishing causation and maintenance as different relations in the mental model, we can construct an argument for CCFs as independent building blocks of lexical semantic representations. This is because verbs of maintenance seem to project a CCF argument, as we will now argue.

As was the case with causation, we can distinguish a range of factors that enter into the maintenance of a state. For example, for a city to be safe, it may not be enough that it is surrounded by a wall. Defenders need to be present, as do weapons to be used by the defenders. In addition, it may be relevant whether the city has entered into a pact with neighbouring cities or not. Further factors may include the weather or the city's geographical location. Each of these factors can in principle function as the external argument of *protect*. (For example, given an appropriate scenario, a persistent easterly wind or the fog could protect the city.) This suggests that verbs of causation and verbs of maintenance share not only some notion of resultant state but also the notion of CCF. We may therefore assign them very similar lexical semantic representations, as in (25) below.

(25) a. $\lambda y\, \lambda x\, [[_e\, x\, [_s \ldots\, y \ldots]]\, \&\, x = \text{CCF}]$
b. $\lambda y\, \lambda x\, [[_s\, x\, [_s \ldots\, y \ldots]]\, \&\, x = \text{CCF}]$

Further support for the representation in (25b) comes from the observation that apparently causative verbs can receive a state reading expressing maintenance. Some representative examples are given in (26).

(26) a. These hairs obstruct the sink.
b. The government's position on immigration annoys Mary.
c. This dial shows us the temperature of the nuclear core in our reactor.
d. The pollution in the Gulf endangers the pelican population.

Each of the verbs in (26) allows a causative reading in which some state initially does not hold, but comes into existence as a culmination of the macro event. However, they also allow an alternative static reading in which the resultant state is maintained as a consequence of some other state of affairs. For example, in (26a), the obstruction of the sink can be interpreted as a state maintained as a consequence of the presence of hairs. This suggests that the verb *obstruct* can have the lexical semantics in either (25a) or (25b). (Alternatively, the macro event is underspecified and can in appropriate contexts be interpreted as either an event or a state.) As the reader can check easily, the static interpretation of the verbs in (26) is incompatible with anaphoric reference using 'This happened …'. Such a continuation forces a causative reading.

The existence of verbs that alternate between a causative and a maintenance interpretation supports the view that CCF is a building block of lexical semantics used beyond the domain of causative predicates. Otherwise the ambiguity of the verbs in (26) would require a simultaneous change in event class and in the content of the external theta-role. This is because the theta-role in question would be classified as a cause on the causative

reading of the verb, while it could not be interpreted as such on the maintenance reading. However, although the intuition of native speakers supports an alternation in event class, we doubt that any evidence can be found for an alternation in the content of the external theta-role.

A further speculative, but potentially very strong, argument for the existence of the semantics we have associated with verbs of maintenance comes from the interpretation of the middle voice construction (see Ackema and Schoorlemmer 2005 for an overview). In particular, we suggest that the predicate in an example like (27a) is associated with the interpretation in (27b):

(27) a. This book reads easily.
b. λx Gen(y) $[[_{s1}$ x $[_{s2}$ e_3 y]] & x=CCF_{s2} & $e_3=[_e$ y x]]
c. Gen(y) $[[_{s1}$ this book $[_{s2}$ e_3 y]] & this book=CCF_{s2} & $e_3=[_e$ y this book]]

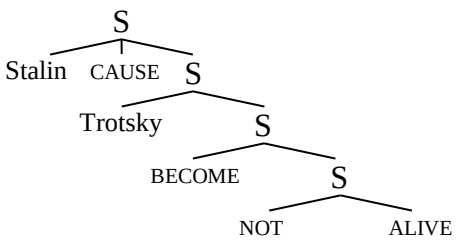
We take *easily* to have a hidden experiencer. If so, we can paraphrase the representation in (27c), which results from applying (27b) to *this book*, as follows: the book is the crucial contributing factor in maintaining a state s_2 in which a generic reader experiences the reading event e_3 as easy. Or, more informally, the book is such that, if one reads it, the reading is easy. The middle in (27a) expresses a relation of maintenance because the state in which the reading is experienced as easy is maintained by the activity of reading this book. Furthermore, the book must be classified as a CCF because properties of the book are instrumental in bringing about the maintenance relation (for example, the book might be written in simple prose or printed in a pleasant font). On no analysis of middles familiar to us are they analyzed as causatives. Therefore, if our characterization of middles is correct, they provide strong evidence for the claim that CCFs exist outside of causative predicates.

The fact that CCFs can be found with non-causative predicates implies that their presence in causative predicates cannot be construed as an argument for the claim that such predicates encode a causing event. But this means that there is no longer any positive evidence for the existence of causing events in the linguistic representation, an issue we explore more fully below.

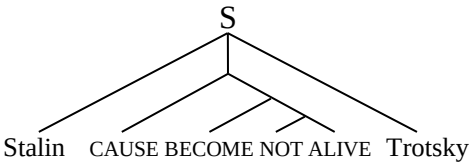
5. Tests for the presence of causing events

In this section we explore how causing events are represented in theories that assume a complete encoding of the causative relation in the semantics of verbs like *kill*. The most interesting proposals for current purposes assume some type of syntactic decomposition. This style of analysis goes back to generative semantics (see Lakoff 1970 and McCawley 1976). McCawley argues that *Stalin killed Trotsky* has an underlying structure as in (28a), which is related to the surface representation in (28b) through successive applications of predicate raising, followed by application of a rule that spells out the resulting complex as *kill* (see (28c)).

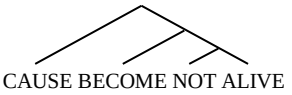
(28) a.



b.



c.



$\Rightarrow$ *kill*

The stated aim of generative semantics is to develop a theory of syntax whose underlying structures are transparent representations of sentence meaning. It is therefore striking that the representation in (28a) does not contain any hint of a causing event. The predicate CAUSE relates an individual to an event. It does not relate two events. Thus, although an attempt is made to express causation syntactically, the syntactic structure used for this does not match the definition in (1).

The mismatch identified here has not gone unnoticed and the general solution in theories assuming decomposition of causative predicates is to attribute a richer meaning than expected to the CAUSE predicate. Dowty (1979), for example, suggests the following definition of the CAUSE predicate:

(29) a. If *t* is a singular term and φ a formula, CAUSE(*t*, *φ*) is also a formula.
b. "CAUSE(*t*, *φ*)" is true at instant *i* in world *w* iff there is a property P such that P(*t*) and *φ* are both true at *i* in *w* and in all worlds *w'* that minimally differ from *w* and in which *φ* is untrue, P(*t*) is untrue as well.

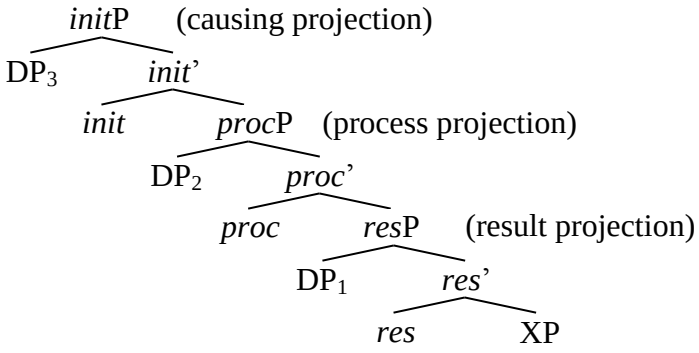
The definition in (29) does two things. On the one hand, it makes it possible for the CAUSE predicate to take an individual as its subject. On the other, it introduces the causing event as part of the meaning of that predicate. Thus, while the singular term *t* cannot be a cause, P(*t*) *can* characterize (part of) a causing event. In *John broke the window*, the example we used in the introduction, P might be *swing an arm while holding a hammer*, *t* might be *John* and *φ* would be *the window breaks*.[5] In this way, the fact that causative verbs typically take a non-eventive subject can be reconciled with the a priori assumption that natural language expresses the concept of causation fully.

Dowty's proposal may be an adequate characterization of the interpretation of causal predicates, but it also amounts to an admission that causation is not expressed linguistically. That is to say, the fact that causation is a relation between events does not have an expression in the linguistic structure. P is hidden in the definition of the CAUSE predicate, and therefore it is not immediately obvious how its presence can be empirically tested. Thus, even in these early proposals that aim to represent causation through syntactic decomposition, decomposition does not include a transparent representation of the causing event.

This mismatch between the concept of causation and its supposed syntactic expression is inescapable, because it is a fact of language that the external argument of causative predicates typically is an individual. It is therefore hardly surprising that the structure proposed in recent successors of generative semantics shares the relative opacity of the causing event seen in (28). Consider, for example, the representation of causative predicates proposed by Ramchand (2008) (see also Hale & Keyser 1993):

[5] The mention in (29) of worlds minimally different from *w* takes care of the problem of oversimplification: all other factors in the diagram in (2) are kept constant. This is important because *φ* might be false and P(*t*) true if any of the other factors varies sufficiently. For example, the window might not break if made of bullet-proof glass.

(30)



The representation in (30) has the same overall geometry as (28a). The *init*P corresponds to the S projected by CAUSE in (28a), the *proc*P corresponds to the S projected by BECOME, while *res*P is a small clause whose predicate corresponds to the culminating state constituted by NOT ALIVE in (28a). Given this shared geometry, (30) also does not provide a transparent representation of the concept of causation and in particular of the causing event. In fact, the solution proposed by Ramchand is similar to Dowty's suggestion, although technical details vary. Ramchand characterizes *init*P as a whole as a macro-event expressing causation and defines its head *init* as follows:

(31) $[[\text{init}]] = \lambda P\, \lambda x\, \lambda e\, \exists e_1,e_2[P(e_2)\ \&\ \text{init'}(e_1)\ \&\ \text{State}(e_1)\ \&\ e= e_1 \rightarrow e_2\ \&\ \text{Subject}\ (x,e_1)]$

As in (29), the causing event in (31), e_1, is part of the semantic representation of the *init* head but is unlikely to have syntactic effects, because it is existentially bound within this head. What *is* projected is a single participant of the causing event; this 'initiator' occupies the specifier position of *init*. Furthermore, the causal relation between the causing subevent introduced by *init* and the event denoted by *proc*P is also not syntactically represented. It is introduced as part of the lexical semantics of *init*, completely on a par with the approach in Dowty (1979). In other words, neither the causing event nor causal relation corresponds to a syntactic constituent, so that their presence cannot be probed by standard syntactic tests.

We could ask whether there is any other evidence that might confirm the presence of a causing event. One possibility would be to capitalize on examples like (32a), in which the subject of causative verb denotes an event. Indeed, Pylkkänen (2008) suggests that this possibility results from identification of the subject with the causing event. However, this analysis runs into severe difficulties, because the temporal specification of eventive subjects may identify them as following the resultant state, as shown by (32b). This is easily understood if the subject of a causative verb is a CCF: knowledge of a future event may constitute a crucial contributory factor to events in the present. However, the grammaticality of (32b) is incompatible with the claim that eventive subjects identify causing events.

(32) a. Strike action by London Underground staff is causing mayhem on the North Circular Road.
b. Tomorrow's strike by London Underground staff is causing mayhem on the North Circular Road tonight.

An alternative source of potential evidence for the linguistic encoding of causing events would be interpretive restrictions on the subject. For example, we accept as evidence for the existence of a resultant state in a verb like *break* that the internal argument of this verb is always such that this state holds of it (in the absence of negation). In fact, the point of

postulating a resultant state in *break* is this fixed interpretive effect. In principle, the presence of a causing event in a verb like *kill* could be motivated in parallel fashion. Suppose, for example, that the causing event were always a specific activity and moreover that the external argument were always the person performing that activity. Under these conditions, we could construct an argument for the causing event based on the fixed interpretation of the external argument. But, as far as we are aware, such a fixed interpretation is absent (unless the verb encodes the use of an instrument, of course). Consider, for example, the data below, which illustrate the range of interpretations available for the subject of *kill*.

(33) a. Drinking too much wine eventually killed Leo.
b. Whisky eventually killed Leo.
c. A hammer eventually killed Leo.
d. The flood eventually killed Leo.
e. Bill eventually killed Leo.
f. The distance to the nearest oasis eventually killed Leo.
g. The thinness of his skull eventually killed Leo.
h. His clumsiness eventually killed Leo.
i. His desire to climb Mount Everest eventually killed Leo.
j. The lieutenant's bad mood eventually killed Leo.

We do not want to suggest that the authors above have not noticed this variability in possible external arguments. Dowty leaves open the nature of P in (29), while Ramchand introduces the external argument using a predicate labeled 'Subject' in (31). However, in the absence of any explicit hypotheses about the relation between the external argument and the causing event, it is not possible to use the interpretive properties of the subject as a test for the presence of that event.

A similar potential test for the presence of an embedded eventuality can be based on interpretive relations between arguments. In a ditransitive verb like *show* the presence of a resulting eventuality is signaled by the constant semantic relation between the two internal arguments, namely one of inclusion of the direct object in the indirect object's visual field. Thus, if John shows Mary the picture, then Mary must be able to see the picture. Similar relations can be observed with other ditransitive verbs. However, it is never possible for two participants of the causing event to be realized syntactically. Therefore, no similar evidence can be produced for the syntactic representation of this event. Notice that it is very unlikely that the impossibility of projecting two participants of the causing event has an interpretive basis, given the wide variety of interpretations available for external arguments. Although we will not pursue this here, the absence of structures in which two arguments are associated with the causing event can be construed as undermining the claim that this event is syntactically represented in the first place.

A different kind of test for the linguistic presence of causing events is suggested by Pylkkänen (2008). This author shares some of the basic ideas about argument structure with Dowty, Hale and Keyser, and Ramchand, but assumes that the causing event and the associated external argument are introduced – at least in some languages – by separate functional heads, labeled Cause and Voice. She then goes on to argue that in such languages the causing event can be present in the absence of an external argument. The evidence for this claim comes from the distribution of modifiers that mention a causing event. More specifically, Pylkkänen's suggestion is that at least some of these modifiers can only be added to a structure that has a Cause projection (and hence an implicit causing event). Therefore, if such a modifier is licit, then this provides evidence for the presence of a causing event. The core paradigm is provided by Japanese examples demonstrating a contrast

between so-called adversity causatives and various unaccusative structures. The adversity causative allows a *ni-yotte* modifier naming a causing event, but unaccusatives are claimed to be incompatible with such modifiers:[6]

(34) a. Taroo-ga sensoo-ni-yotte musuko-o sin-ase-ta.
Taro-NOM war-BY son-ACC die-CAUSE-PAST
'Taro's son was caused to die on him by the war.'

b. *Yasai-ga kouon-ni-yotte kusa-tta
vegetable-NOM high.temperature-BY rot-PAST
'The vegetable rotted by the heat.'

Pylkkänen uses this contrast to argue that a causing event is present in (34a) but not (34b).

The problem with this argument is that at least some modifiers naming causing events *can* be added to unaccusative structures. We have already seen an example of this in (4b), repeated here as (35a). Although it is certainly not the case that every type of causative modifier can be attached to any accusative structure, all unaccusative structures allow the addition of at least some causative modifier:

(35) a. Little Orson grew into a big man by eating John McCann's Steel Cut Irish Oatmeal.
b. John died from pneumonia.
c. John left by taking a taxi.
d. The vegetable rotted because of the high temperature.
e. John evaporated due to his not having paid his existence tax.

It is therefore crucial for the validity of Pylkkänen's test that the particular modifier it relies on systematically resists insertion in unaccusative contexts. The fact of the matter, however, is that many unaccusative contexts do allow insertion of *ni-yotte* phrases. Some representative examples are given below.

(36) a. Taroo-wa hahaoya-no hukai aijoo-ni-yotte takumashiku seichooshi-ta.
Taroo-TOP mother-GEN deep love-BY strong grow-PAST
'Taro grew strong through the deep love of (his) mother.'

b. Sono-mura-wa tekikoku-no sinryaku-ni-yotte chizu-zyoo-kara
that-village-TOP hostile invasion-BY map-on-from
shoometsushi-ta
disappear-PAST
'That village disappeared from the map because of the hostile invasion.'

c. Sono-sensuikan-wa tekikoku-no hageshii koogeki-ni-yotte chinbotsushi-ta
that-submarine-TOP hostile severe attack-BY sink-PAST
'That submarine sank as a result of the hostile severe attack.'

d. Taro-wa senchoo-no tadaina jinryoku-ni-yotte toutou hokkyoku-ni
Taro-TOP captain-GEN great exertion-BY finally Arctic-at
tootatsuushi-
ta.
arrive-PAST
'Taro finally arrived at the Arctic through the captain's great exertion.'

[6] We have not been able to find any informants who accept the adversity reading for causative constructions (whether a *ni-yotte* phrase is present or not). This suggests that further research is required to determine how widespread the distribution of the adversity causative is among speakers of Japanese.

Pylkkänen presents Finnish desiderative causatives as a further construction that lacks an external argument but encodes a causing event. An example of a desiderative causative is given in (37). The fact that this example can be paraphrased as 'Something makes Maija feel like singing' forms the basis for the claim that a causing event is present. *Maija-a* is taken to occupy the subject position, so that an account involving a silent causer is ruled out.

(37) Maija-a laula-tta-a.
Maija-PART sing-CAUSE-3SG
'Maija feels like singing.'

The crucial test used to provide evidence for the presence of a causing event in structures like (37) is based on sluicing structures in which *mikä* 'what' survives as a remnant. The idea is that such structures can be coordinated with a preceding clause as long as that clause contains a causing event. A desiderative causative can appear in the relevant context (see (38a)), passing the proposed test for causing events, but a non-causative desiderative structure like (38b) cannot.

(38) a. Minu-a naura-tta-a mutt-en tiedä mikä.
I-PART laugh-CAUSE-3SG but-not.1SG know what.NOM
'Something makes me feel like laughing but I don't know what (makes me feel like laughing).'

b. *Halua-isi-n nauraa mutt-en tiedä mikä.
want-COND-1SG laugh but-not.1SG know what.NOM
'I want to laugh but I don't know what (makes me want to laugh).'

In evaluating the validity of the proposed test, it is important to note that the logic that motivates it leads to the prediction that causative structures with an overt subject representing a participant in the causing event should pass it. The reason for this is that the presence of such a subject does not identify the nature of the causing event and therefore it should be possible to state that one does not know what that event is. In English, it is clearly the case that the relevant structure cannot be added to causatives with a subject of the relevant type. The interpretation of (39c) is very similar to that of (39a) and (39b) on an analysis of causatives that assumes a hidden causing event, but (39c) does not pass Pylkkänen's test.

(39) a. Something that John did made me laugh, but I don't know what.
b. John did something that made me laugh, but I don't know what.
c. *John made me laugh, but I don't know what.

It could of course be the case that the conditions on sluicing in Finnish are different from those in English, but in fact the Finnish equivalent of (39c) is ungrammatical as well:

(40) a. Jokin sai minut nauramaan mutt-en tiedä mikä.
something.NOM get.PAST.3SG me.ACC laugh.INF.ILL but-not.1SG know what.NOM
'Something made me laugh but I don't know what (made me laugh).'

b. *Pekka sai minut nauramaan mutt-en tiedä mikä.
Pekka.NOM get.PAST.3SG me.ACC laugh.INF.ILL but-not.1SG know what.NOM
'Pekka made me laugh but I don't know what (Pekka did that made me laugh).'

It would take us too far afield to develop an analysis of the Finnish desiderative causative. However, Finnish is a partial pro-drop language and therefore underspecified pronouns like weather *it* are omitted (alongside first and second person pronouns). It is therefore a possibility that the causative desiderative should be analysed as involving pro-drop, as below. This would immediately explain the grammaticality of (38a). (Notice that the partitive marking of *Maija* is consistent with an analysis of this constituent as an object, as argued in some detail by Pylkkänen.)

(41) *pro* Maija-a laula-tta-a.
Maija-PART sing-CAUSE-3SG
'Maija feels like singing.'

In conclusion, although there are many theories that assume a linguistic encoding of causing events, there is a distinct paucity of tests that can be used to confirm analyses along those lines.

6. Conclusion

We have argued that the linguistic representation of causation does not include a causing event, although we assume that causing events are present in the mental model that people construct to understand the world. Natural language approximates causation by representing culmination of events and a CCF subject. Both of these building blocks of lexical semantics are also found in non-causative verb classes. It should not come as a surprise that the linguistic expression of causation underdetermines the mental model to which it corresponds: that is the normal state of affairs for any linguistic representation.

It is of course impossible to prove a negative and therefore we cannot provide conclusive evidence for the absence of causing events in linguistic structures. However, we have been able to show that phenomena that might be construed as providing support for a full representation of causation in fact do no such thing. Most prominent among these is the apparent restriction to direct causation in simple causatives. We have shown that such a restriction faces a number of counterexamples and that observations supporting it can be reinterpreted in different terms.

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7. Bibliography

Ackema, P., & Schoorlemmer, M. (2005). Middles. In M. Everaert, & H. van Riemsdijk (Eds.), *The Blackwell companion to syntax* (Vol. III, pp. 131-203). Oxford: Basil Blackwell.

Bittner, M. (1999). Concealed Causatives. *Natural Language Semantics, 7*(1), 1-78.

Chierchia, G. (2004). A semantics for unaccusatives and its syntactic consequences. In A. Alexiadou, E. Anagnostopoulou, & M. Everaert (Eds.), *The unaccusativity puzzle* (pp. 22-59). Oxford: Oxford University Press.

Doron, E. (1999). Semitic Templates as Representations of Argument Structure. *Proceedings of the Texas Linguistics Societ: Conference on Perspectives on Argument Structure.* Austin: University of Texas.

Dowty, D. (1979). *Word meaning and Montague grammar*. Dordrecht: Reidel.

Fodor, J. (1970). Three Reasons for Not Deriving "Kill" from "Cause to Die". *Linguistic Inquiry, 1*(4), 429-438.

Hale, K., & Keyser, S. J. (1993). On Argument Structure and the Lexical Expression of Syntatic Relations. In K. Hale, & S. J. Keyser (Eds.), *The View from Building 20* (pp. 53-110). Cambridge: MIT Press.

Johnson-Laird, P. (1983). *Mental Models: Towards a Cognitive Science of Language, Inference, and Consciousness.* Cambridge: Cambridge University Press.

Katz, J. (1970). Interpretive Semantics vs Generative Semantics. *Foundations of Language, 6*(2), 220-259.

Kratzer, A. (2000). Building statives. In L. Conathan (Ed.), *Proceedings of the 26th Annual Meeting of the Berkeley Linguistics Society*, (pp. 385-399). Berkeley.

Lakoff, G. (1970). *Irregularity in Syntax.* New York: Holt, Rinehart & Winston.

Leslie, A. M. (1984). Spatiotemporal continuity and the perception of causality in infants. *Perception, 13* , 287-305.

Leslie, A. M. (1986). The necessity of illusion. In L. Weiskrantz (Ed.), *Thought without language* (pp. 185–210). Oxford: Clarendon Press.

Leslie, A., & Keeble, S. (1987). Do six-month-old infants perceive causality? *Cognition, 25*, 265–288.

Levin, B., & Rappaport-Hovav, M. (1995). *Unaccusativity, at the syntax-lexical semantics interface.* Cambridge, Mass: MIT Press.

Lewis, D. (1973). Causation. *Journal of Philosophy, 70*(17), 556-567.

Maienborn, C. (2003). *Die logische Form von Kopula-Sätzen.* Berlin: Akademie-Verlag.

Maienborn, C. (2005). On the limits of the Davidsonian approach: The case of copula sentences. *Theoretical Linguistics, 31*, 275–316.

Maienborn, C. (2008). On Davidsonian and Kimian states. In I. Comorovski, & K. v. Heusinger (Eds.), *Existence: Semantics and Syntax* (pp. 107-130). Dordrecht: Kluwer.

McCawley, J. (1976). *Grammar and Meaning.* New York: Academic Press.

Oakes, L. (1994). Development of infants' use of continuity cues in their perception of causality. *Developmental Psychology, 30*, 869–879.

Parsons, T. (1990). *Events in the Semantics of English.* Cambridge, Mass: MIT Press.

Pylkkänen, L. (2000). On Stativity and Causation. In C. Tenny, & J. Pustejovsky (Eds.), *Events as Grammatical Objects. The Converging Perspectives of Lexical Semantics and Syntax* (pp. 417-445). Stanford: CSLI Publications.

Pylkkänen, L. (2008). *Introducing arguments.* Cambridge, Mass: MIT Press.

Ramchand, G. (2008). *Verb Meaning and the Lexicon: A First Phase Syntax.* Cambridge: CUP.

Reinhart, T. (2000). *The Theta System: Syntactic realization of verbal concepts.* OTS Working Papers, Utrecht University.

Reinhart, T. (2003). The Theta System: An Overview. *Theoretical Linguistics, 28*(3), 229-290.

Varley, R. (2002). Science without grammar: Scientific reasoning in severe agrammatic reasoning. In P. Carruthers, S. Stich, & M. Siegal (Eds.), *The Cognitive Basis of Science* (pp. 99-116). Cambridge: Cambridge University Press.

Varley, R., & Siegal, M. (2002). Language, cognition, and the nature of modularity: Evidence from aphasia. *Behavioral and Brain Sciences, 25*, 702-703.

Wolff, P. (2003). Direct Causation in the Linguistic Coding and Individuation of Causal Events . *Cognition, 88*(1), 1-48.