Burning facts: thick and thin causatives*

Fabienne Martin
Utrecht University

David Rose
Stanford University

Shaun Nichols
Cornell University

Abstract Lexical causative verbs are traditionally assumed to pattern uniformly: they specify only a result state, leaving the manner of causing unarticulated, like the overt *cause*. We argue that this view obscures a fundamental division within English causative verbs. Building on Rose et al. (2021), we show that a substantial subset of causatives – thick causatives such as *burn, melt, break, bury* – encode information about the way a change is brought about, and that this specification yields systematic semantic and pragmatic restrictions. Thick causatives in their physical sense resist subjects that denote absences, facts, degrees, or events that fail to instantiate the appropriate productive (force-transmitting) mechanism, in contrast to thin causatives like *kill, destroy,* and *change*, which readily combine with such subjects. Using corpus evidence from a representative sample of 37 frequent English causatives, we demonstrate (i) that most thick causatives pattern like Embick's 2009 *break*-causatives –compatible with strong adjectival resultatives and requiring production-based causation – while (ii) some thick causatives (e.g., *bury*) encode the relevant manner information via the state they lexicalize rather than via an event predicate. We develop a pragmatic competition account linking the production constraint to the directness constraint, yielding a unified explanation for the distribution of thick vs. thin causatives in English.

Keywords: Thick causatives; Thin causatives; Lexical causatives; Manner/production causation; Direct causation; Causal semantics

1 Introduction

Since the early foundational work in lexical semantics (see, e.g., Levin 1993, Levin & Rappaport Hovav 1995, Levin & Rappaport Hovav 2013), it is generally thought that one of the hallmarks of lexical (covert) causative verbs – also known as result verbs – (e.g., *kill*, *burn*) is that they do not specify any property of the events in their extension, just like overt causatives such as *cause*. They only lexicalize a property of some result caused by these events (e.g., death in the case of *kill*). Non-causative transitive manner verbs (e.g., *hammer*, *wipe*, *wash*), by contrast, do specify a way of acting. The quotes below contrasting causative verbs with manner verbs like *hammer* make the point clear (italics ours):

> [Result verbs] *specify what was done, not how it was done*. (Brousseau & Ritter 1991: 56)

* We thank...

Version 1, November 23, 2025, comments very welcome!

> With verbs [such as *destroy* and *kill*], the result state is lexically specified, whereas *the activity that causes the result is left unspecified*. For example, consider the verb *destroy*: there are many ways to destroy something, but no matter how the destruction is accomplished, the result is that that thing no longer exists. (Levin & Rappaport Hovav 1995: 50)

> Whereas *causative verbs do not specify the way in which the change is brought about*, manner verbs specify the way in which the agent acts on the patient. (Kaufmann 2002: 348)

> [...] result verbs *do not specify any manner of action*. (Rappaport Hovav 2016: 96)

The standard view is thus that lexical (covert) causatives, just as overt causative verbs like *cause*, remain completely silent about the manner in which the effect is triggered. In the semantic representation (1b) of the lexical causative statement (1a), this is reflected in the fact that no property is predicated over the causing event e. What the verb *kill* lexicalizes is a property of a state (in (1) and elsewhere, we ignore the irrelevant tense information).

(1) a. Yusupov killed Rasputin.
b. $\lambda e.\exists s(\mathsf{agent}(e,\mathsf{yusupov}) \wedge (\mathsf{cause}(e,s) \wedge \mathsf{dead}(s) \wedge \mathsf{theme}(s,\mathsf{rasputin}))$

Given their complete lack of specification about the way the outcome is achieved, these verbs – that we shall label *thin* causative verbs for reasons made clear below – are compatible with subjects describing a very wide variety of ways of causing, as illustrated in (2):

(2) { Overwatering / Underwatering / Extreme heat / Cold drafts / Fungus / Root rot / Pest infestation / Poor drainage / Low humidity / Compacted soil / Chemical exposure / Improper pot size / Inadequate nutrition / ... } killed / destroyed my plants.

While this characterisation of causative verbs is very intuitive for verbs like *kill*, *destroy* or *cause*, it does not seem to fit all causative verbs. Take, for example, the verb *burn* used transitively.

Intuitively, this verb does say something about *how* destruction takes place. This is also reflected in the dictionary definitions of this verb, as the following extracts from Merriam-Webster's definitions illustrates (emphasis ours):

(3) *burn* (transitive verb):

a. to destroy (something) *by fire*
b. to transform (something) *by exposure to heat or fire*
c. to injure or damage (something or someone) by or as if *by exposure to fire, heat, or radiation*

Because *burn* specifies the way the outcome is triggered, it is, unsurprisingly, more restrictive in the type of subject it accepts. When the subject is an animate agent, the manner specification can unproblematically be accommodated; for instance, interpreting a sentence such as *Peter burned the house*, we simply infer that Peter destroyed the house in a way complying with the manner of causing conveyed by the verb. But *inanimate* subjects of causative verbs typically describe the cause of the result lexicalized by the verb (Davis & Demirdache 2000, Doron 2003, Levin & Rappaport Hovav 2005, Kallulli 2006, Folli & Harley 2007, Schäfer 2008, Alexiadou et al. 2015, Martin et al. 2025). Therefore, they felicitously combine with verbs like *burn* only if they refer to a cause instantiating the right way of causing (as the subjects in (4a) do). Otherwise, the sentence becomes awkward (as in (4b)).

(4) a. { Direct sunlight / Intense heat / Chemical fertilizer / The hot radiator / Strong chemical spray / Scalding water / Strong grow lights / The electrical short / ... } burned my plants.

b. { #Overwatering / #Cold drafts / #Fungus / #Root rot / #Pest infestation / #Poor drainage / #Compacted soil / #Improper pot size } burned my plants.

We call *thick* causative verbs those verbs like *burn* that seem to convey information about the way the new state is caused.

The selectional restrictions that thick causative verbs impose on the subject were recently investigated in Rose et al. (2021); see also Rose et al. (2025). The question addressed in this study

was whether the CAUSE operator has exactly the same meaning when encoded by the verb *cause* and lexical causative verbs. Theories about causation and the meaning of CAUSE are divided into two families (in linguistics, see discussion in Copley & Wolff 2014, Kistler 2014, Beavers & Koontz-Garboden 2020: 48–50). In production theories of causation (Dowe 2000 among others, or Croft 1991, Talmy 2000, Wolff 2007, Copley & Harley 2015, Copley et al. 2015, Copley 2019 in linguistics), causation involves the transmission of some physical quantities like energy or force from cause to effect. In contrast, in dependence theories of causation, causation involves a dependence relation between causes and effects. This dependence relation is usually understood in terms of counterfactual dependence: had the cause not occurred then neither would the effect (Lewis 1973, Lyon 1967, Paul 2009, or Dowty 1979 for applications on linguistic data; see also counterfactual-based causal modeling approaches developed in Hitchcock 2001, Halpern & Pearl 2005, and Schulz 2011, Nadathur & Lauer 2020, Alonso-Ovalle & Hsieh 2021, McHugh 2023, Nadathur 2023, Cao et al. 2025, Baglini & Bar-Asher Siegal 2025 for applications of such approaches in semantics). Causal dependencies have also be modeled through probabilities: when B causally depends on A, A increases or decreases the probability of B (Reichenbach 1959, Suppes 1973, Cartwright 1979,Williamson 2009; see Merin 1999, Hobbs 2005, Martin 2018 for applications in linguistics).

Rose et al. (2021) looked at absences and omissions as a test case to distinguish dependence and production theories of causation. Absences cannot transfer energy, but are nevertheless often represented as causes. For instance, sentence (5a) below is a natural thing to say. Causal judgments – at least when expressed with the verb *cause* – thus seem to make the case for dependence theories. But Rose et al. (2021) point out that the linguistic intuition flips once one replaces *cause* with a lexical causative like *burn*, see (5b)).

(5) a. The lack of sunscreen caused Jane's skin to burn.
b. #The lack of sunscreen burned Jane's skin.

More of Rose et al.'s (2021) contrasts are repeated in (6)-(7):

(6) a. The lack of a heat shield caused the rubber gasket to melt.
b. #The lack of a heat shield melted the rubber gasket.

(7) a. The lack of a basement window caused the cellar to flood.
b. #The lack of a basement window flooded the cellar.

Rose et al. take these findings to support the view that we may operate with *two* CAUSE concepts rather than one: a production-based P-CAUSE concept, expressible with covert (lexical) causatives, and a dependent-based D-CAUSE concept, preferably expressed via the overt causative *cause* (see also Lombrozo 2010, Godfrey-Smith 2010, Hall 2004). We call the constraint that Rose et al. (2021) associate with lexical causatives the production-based causation constraint (or production constraint for short):

(8) PRODUCTION-BASED CAUSATION CONSTRAINT: lexical causative verbs (preferably) convey the production-based notion of causation.

An immediate problem for a theory that incorporates this constraint without further qualifications is that verbs like *burn* are perfectly compatible with absences when they are used in a non-physical (e.g. psychological, abstract) sense, as shown in (9). This is unexpected if the CAUSE operator in the semantic representation of lexical causative statements always preferably conveys production causation (the source of natural examples such as those in (9) is provided at the end of the paper).

(9) a. De Rossi's complete lack of discipline burned this team.[ex1]
b. His [...] utter lack of egotism melted me completely.[ex2]
c. The lack of colour flooded his thoughts.[ex3]

Furthermore, as Rose et al. (2021) note in passing, it is not the case that all lexical causative verbs reject absences in the subject position even when used in a physical sense. They mention *kill*, and one finds other inherently transitive (i.e. non-alternating) verbs, like *destroy* or *trigger*, pattern similarly:

(10) a. The lack of water killed my plants.
b. Lack of oxygen damaged her brain.[ex4]
c. A lack of supplies triggered a great famine.[ex5]

Verbs in (10) do not endure the *causative/anticausative alternation* (Levin 1993, Levin & Rappaport Hovav 1995, Schäfer 2009, Rappaport Hovav 2014, Alexiadou et al. 2015, Kim et al. 2025), while *burn* and other verbs investigated in Rose et al. (2021) do. That is, while *burn* can be used both as a transitive and an intransitive verb, *kill* only has a transitive use, as shown in (11).

(11) a. Hamida burned the paper/the paper burned.
b. Nina killed the mosquito/*the mosquito killed.

For this reason, one might be tempted to relate the incompatibility with absences of verbs like *burn* to the fact that these verbs enter the causative alternation. But one also finds verbs entering this alternation that are perfectly compatible with absence-denoting subjects, by contrast with thick causative verbs like *burn*:

(12) a. The lack of vitamins changed Jane's skin.
b. [T]he lack of XBP1 activated the other protein.[ex6]

One also finds thick causatives (that reject absences when they are used in a physical sense but accept them in an abstract sense) that do not alternate, i.e. cannot be used intransitively (see **The road buried*):

(13) a. #The lack of drainage buried the road.
b. The lack of drainage caused the road to be buried.
c. The lack of funding buried the project.

How can we explain these contrasts, and the fact that they only appear with thick causative verbs in their physical sense? Why aren't they replicable with all causative verbs in English? What exactly slices the cake between 'omission-friendly' (*kill, change*) and 'omission-allergic' (*burn, bury*) verbs in English?

These questions are all the more relevant because, as we shall see, the allergy to omissions of verbs like *burn* in their physical sense pointed out by Rose et al. (2021) is a symptom of a much broader incompatibility to any subject that denotes *facts* (or other comparably abstract objects like propositions, states of affairs, etc., see Asher 1993, Zucchi 1993, Asher & Lascarides 2003).

This paper explores the idea that the answers to these questions can be found in the difference between thick and thin causative verbs. We propose that what forces the selection of the productive sense of CAUSE is the specification of ways of causing encoded by English causative verbs like *burn* in their physical sense.

On this view, *the lack of sunscreen burned her skin* is weird because the verb *burn* requires its subject's referent to affect the skin by fire, radiation, etc. But absences cannot affect entities in such ways (Rose et al. 2021). By contrast, *The lack of sunscreen destroyed her skin* is fine because *destroy* does not say anything about the way the result is triggered, in accordance with the standard characterization of lexical causative verbs we started with.

Our proposal raises two questions. First, how does the distinction between thin vs. thick causative verbs relate to previous distinctions within the class of causative verbs? Some linguists have argued in favor of a more refined classification of change-of-state verbs (Koenig & Davis 2001, Embick 2009, Beavers & Koontz-Garboden 2012, Beavers & Koontz-Garboden 2020, Pross 2019, Beavers et al. 2021, Hopperdietzel 2024). Particularly relevant for us is the idea that some lexical causatives resemble manner (action, non-causative) verbs like *hammer* in that they lexicalize an event property (rather than a property of a state, like *open*, for instance). More specifically, Embick (2009) and Anagnostopoulou (2017), Alexiadou et al. (2017) and Hopperdietzel (2024) after him proposed that the root of certain causative verbs, like *burn* or *break*, serve as event (manner) predicates. On the basis of a qualitative corpus survey reported in the present paper, we tested the idea that thick causative verbs are in fact such verbs.

Second, what is at the source of the production constraint? Rose et al. (2021) seem to conceive it as the result of a semantic clash: since thick causative verbs encode P-CAUSE (at least in their physical sense), they cannot be combined with subjects that denote a D-CAUSE like omissions. We must however account for why the problem only appears with the concrete meaning of verbs, and also explain why the problem raised by omissions does not appear when the cause is expressed by a prepositional phrase (rather than the subject). When the cause of the change is expressed by a causer PP, it can be a D-CAUSE, even when the verb is used in its physical sense. This is illustrated in the contrasts (14)-(16).

(14) a. My skin burned from the lack of sunscreen.
b. #The lack of sunscreen burned my skin.

(15) a. The vase broke from/due to a lack of proper packing.
b. #The lack of proper packing broke the vase.

(16) a. The pistons cracked from a lack of proper lubrication.
b. #The lack of proper lubrication cracked the pistons.

That the production constraint is only at play when the verb is in competition with another transitive structure, such as an overt causative verb like *cause*, suggests that this constraint is of pragmatic nature and results from the competition between covert and overt causatives (McCawley 1978, Van Rooy 2004, Benz 2006), just like the directness constraint. The latter constraint says that lexical causative verbs must express direct causation between cause and result (McCawley 1978, Wolff 2003), while periphrastic causatives can also express indirect causation. This constraint also only holds for the transitive use of change-of-state verbs, i.e., is not at play when the verb is used intransitively (Schäfer 2012). The parallel between the production and directness constraints thus raises a new question: what is the link between the two?

This paper is structured as follows. Section 2 shows that the contrast between thick and thin causatives with omissions extends to other fact-denoting subjects. Section 3 establishes that the contrast between thin and thick causatives can also be observed with event-denoting subjects. Section 4 investigates the lexical properties of thick and thin causatives on the basis of a corpus survey and situates this new distinction among existing typologies of causative verbs. Section 5 develops a pragmatic account of the production constraint bearing on thick causatives, and section 6 investigates the link between Rose et al.'s (2021) production constraint and the directness constraint.

2 Facts and other abstract objects beyond absences

Just like absences (and differently from eventualities), facts and other abstract objects do not transmit energy: they can 'd-cause' but not 'p-cause' an effect. The fact that Jane forgot her sunscreen is causally responsible for the subsequent burning, but does not 'produce' it in any meaningful sense. Given the production constraint bearing on thick causatives in the physical sense, we therefore expect them to also combine less well than *cause* with other types of subject denoting facts or other kinds of abstract objects. In what follows, we show that Rose et al.'s (2021) contrasts indeed generalize beyond absences. We also show that the 'absence-friendliness' of verbs like *destroy* reflects a more general compatibility with fact nominals or other subjects with abstract reference.

Despite the extensive body of research on fact-denoting expressions (Vendler 1967, Asher 1993, Zucchi 1993, Peterson 1997, Moltmann 2013, Elliott 2020), fact-denoting subjects remain marginally addressed in studies on lexical verbal semantics (Levin & Rappaport Hovav 1995, Beavers & Koontz-Garboden 2020) or in the Voice framework (Alexiadou et al. 2015, but see Martin et al. 2025 for a semantics of Causer Voice accommodating the existence of fact-denoting subjects). They are nevertheless frequent, and deserve more attention. Taking them into consideration also requires rethinking the way CAUSE is defined in these frameworks. Causal dependence is often defined as a relation between events, but as Hall (2004) observes, this is unduly restrictive:

> Quite generally there can be counterfactual dependence between *facts* (true propositions), where these can be "positive", "negative", "disjunctive", or whatever — and where only rarely can we shoehorn the facts so related into the form, "such-and-such an event occurred." (Hall 2004: 254)

A first obvious type of expressions denoting facts are nominals such as 'the fact that...'. A slight issue with these expressions is that they are a bit awkward in descriptions of causation between physical events. Even with the verb *cause*, which normally has a finger in every pie, this type of noun phrases sounds a bit odd and overly formal for describing causation between physical events like the one in (17).

(17) The fact that Lu pulled the trigger caused Dax's death.

Once we assume a context fitting this formal register, though, we can replicate with such subjects the contrasts observed in the previous section between thick and thin causatives:

(18) a. The fact that Andy left the phone on the table caused it to be damaged/burn.
b. The fact that Andy left the phone on the table damaged/#burned it.

(19) a. The fact that Lee heated his lunchbox with its cover in the microwave caused the plastic to be destroyed/to melt.
b. The fact that Lee heated his lunchbox with its cover in the microwave destroyed#melted the plastic.

Verbal gerunds constitute more concise and idiosyncratic fact-denoting expressions to which we turn next.

2.1 Verbal gerunds

As Vendler (1967) first pointed out, verbal POSS-*ing* gerunds such as *Ana's leaving the phone on the table* differ from event-denoting expressions by their incompatibility with event-selecting predicates like *occur, take place*, etc:

(20) *Ana's leaving the phone on the table took place/occurred/began... at noon.

Vendler (1967) takes verbal gerunds to denote facts (see also Asher 1993 for some of them); others analyse them as denoting propositional entities (Portner 1992), state of affairs (Zucchi 1993), possibilities (Asher & Lascarides 2003), event kinds (Grimm & McNally 2015) or Kimian states (Huang 2023). For our purposes, these differences are of little importance, since entities of all these ontological categories are abstract objects and thereby not production causes.

As the examples below show, thick causative verbs taken in their physical sense do not welcome verbal gerunds in the subject position, unlike *cause*.

(21) a. Andy's leaving the phone on the table caused it to burn.
b. #Andy's leaving his phone on the table burned it.

(22) a. Lee's heating his lunchbox with its cover in the microwave caused the plastic to melt.
b. #Lee's heating his lunchbox with its cover in the microwave melted the plastic.

(23) a. John's blocking the drainage system caused the basement to flood.
b. #John's blocking the drainage system flooded the basement.

When the same verbs are used in an abstract sense, however, they do accept verbal gerunds in subject position:

(24) a. Tom's telling that story during the interview burned his chances at that job.
b. Iran's accepting the principle of a cease-fire melted their resistance to the idea.
c. Callas' singing *Casta Diva* flooded me with emotions.

On the other hand, thin causatives more readily accept verbal gerunds as an external argument, even when taken in a concrete, physical sense. For instance, the pairs in (25)-(27) form much weaker contrasts than the pairs in (21)-(23):

(25) a. Josh's plugging the socket in the wrong voltage caused it to be damaged.
b. Josh's plugging the socket in the wrong voltage damaged the computer.

(26) a. My neighbor's not watering my plants caused them to die.
b. My neighbor's not watering my plants killed them.

(27) a. Camacho's inspecting the package caused the detonator to be triggered.
b. Camacho's inspecting the package triggered the detonator.[ex7]

We conclude from this data that thick causative verbs are difficult to combine with a subject denoting an abstract entity like a fact, while thin causative verbs accept them more easily. This conclusion will be further corroborated when we turn to a last type of subjects with abstract reference.

2.2 Dimensional nouns

Determiner phrases (DPs) formed with nouns like *level, intensity, quality, condition...* serve as the subject of *cause*:

(28) a. The low quality of the potting soil caused my plants to die.
b. The miserable quality of the powder caused the guns to foul.[ex8]

The referent of these DPs is an abstract object. For instance, these DPs are not very happy as complements of verbs of perception, unlike expressions denoting tropes, which are concrete entities (Moltmann 2013).

(29) a. ?Irene observed the extreme intensity of the sun's rays.
b. ?Angelika saw the low quality of the potting soil.
c. ?Itamar saw the poor quality of the bread.

Nouns like *intensity, quality* or *level* are functional nouns (see Löbner 2020 and references therein). We can treat these nouns as functions applying to an object x (the possessor) and then to a time t, yielding the quality (or intensity, level, etc.) of x at t, as formalized in (30), where ι is the description operator and d is an individual variable for quality degrees.

(30) quality $\rightsquigarrow \lambda x \lambda t . \iota d(\mathsf{quality}(t,x) = d)$ (the quality d of x at t)

The quality d of the potting soil at an implicit time t' is represented in (31).

(31) the quality of the potting soil (at t') $\rightsquigarrow$
$[[\lambda x \lambda t . \iota d(\mathsf{quality}(t,x) = d)](\mathsf{the\ potting\ soil})](t') =$ (by application)
$\iota d(\mathsf{quality}(t', \mathsf{the\ potting\ soil}) = d)$ (for a value of t')

Under this analysis, DPs such as *the (low) quality of the potting soil* describe a quality degree. Since degrees cannot produce *oomph* or *biff*, i.e. cannot act as productive causes, such DPs are another relevant test case for the verbs we look at.

Apart from the degree-based reading, such DPs arguably also have a proposition-/fact-related reading, paraphrasable as below.

(32) The low quality of the potting soil caused my plants to die.
$\approx$ The fact that the quality of the potting soil was low caused the death of my plants.

This suggests that such DPs can also act as concealed fact descriptions in the subject position of causative verbs.[1]

The examples below show that thick causative verbs are awkward with these degree- or fact-denoting DPs built with a dimensional noun in subject position:

(33) a. The extreme intensity of the sun's rays caused Jane's skin to burn.
b. #The extreme intensity of the sun's rays burned Jane's skin.

(34) a. The very poor quality of the plastic caused it to melt.
b. #The very poor quality of the plastic melted it.

1 We can capture this fact-related reading in the semantics via with the function CONT that maps a contentful entity x and a world w to the propositional content of x in w (Kratzer 2006, Uegaki 2015, Elliott 2020 a.o.). For instance, the fact-denoting reading of *the low quality of the potting soil* can be translated as the fact i whose content is that the quality of the potting soil at t' is lower than the standard s in w.

(35) a. The intensity of the winds caused the car to be buried under sand and debris.
b. #The intensity of the winds buried the car under sand and debris.

(36) a. The intensity of the storm caused the town's sewer system to flood.
b. #The intensity of the storm flooded the town's sewer system.

The problem, again, vanishes once the verb is taken in a figurative sense:

(37) a. Such a terrible level of betrayal burned his soul.
b. The extraordinary quality of Gould's performance melted my heart.
c. The extreme intensity of the moment flooded me with thoughts.
d. The extreme degree of this traumatic experience buried the painful memories deep in her subconscious.

Turning to thin causative verbs, we see that the contrast with *cause* is again much weaker with subjects built with a dimensional noun:

(38) a. The appalling quality of the bread caused serious damage to the digestive tract and resulted in chronic malnutrition.[ex9]
b. The appalling quality of the bread damaged the digestive tract and resulted in chronic malnutrition.

(39) a. The high levels of the virus cause an overwhelming inflammatory response to be triggered.
b. [T]he high levels of the virus trigger an overwhelming inflammatory response.[ex10]

(40) a. The poor quality of the potting soil caused my plants to die.
b. The poor quality of the potting soil killed my plants.

(41) a. [T]he moisture level of the wound caused a change in an electrical signal measured by the sensor.[ex11]
b. The moisture level of the wound changed the electrical signal measured by the sensor.

To sum up, we have seen that in their literal, concrete sense, thick causative verbs like *burn* are not very compatible with a subject denoting an abstract object, be it an omission, a fact or a degree, whereas thin causative verbs like *kill* accept such subjects much more easily.

3 Events that do not cause in the right way

The difference between thick and thin causative verbs can also be observed beyond the specific case of subjects with abstract reference. Indeed, thick causative verbs turn out to be picky *even with event-denoting subjects*. They only accept transference causes that can fulfill the way of causing they specify. Contrasts like (42) from Partee (1979: 28-29) (also discussed in Dowty 1979: 97) for verbs like *break* or *boil* show the point, although these authors do not assume these verbs to form a distinct class in the set of lexical causative verbs.[2]

(42) a. #A change in molecular structure broke the window.
b. A change in molecular structure caused the window to break.
c. #The low air pressure boiled the water.
d. The low air pressure caused the water to boil.

Since the referent of the subject DP of sentences (42a/c) can be a transference cause, the problem does not lie there: *the pressure* has a reading under which it denotes a force (*I felt the pressure*), and *a change* denotes an event. Furthermore, these verbs do accept an event-denoting subject as soon as they fulfill the right way of causing, see for instance (43). Thus, the problem cannot just be that thick causative verbs reject events in the subject position.

(43) a. The movement broke the weak clots in the claw marks on his shoulder.[ex12]
b. Intense conflagrations burn all of the dried peat in a forest.[ex13]
c. The heatwave boiled our pipes so it was only hot water.[ex14]

We can therefore safely conclude that Partee's (1979) examples (42b) are awkward because the productive cause described by the subject cannot cause the result in the way specified by the verb.[3] Other contrasts similar to Partee's (1979) are given in (45)-(46).

(45) a. The accident caused her skin to burn.
b. #The accident burned her skin.

2 Partee (1979) takes these contrasts to illustrate the view that lexical and periphrastic causatives do not have the same meaning, and discusses several ways to capture this difference in the semantics, such as: (i) requiring the subject of lexical causatives to be animate or (ii) giving up the assumption that the overt causative *cause* spells out the CAUSE operator encoded by lexical causatives. Option (i) cannot be correct given that as shown through examples (43), these verbs accept non-animate (and non-agentive) event-denoting subjects. Option (ii) is very similar to Rose et al.'s (2021) view according to which lexical causative verbs encode P-CAUSE, while overt causatives can also express D-CAUSE.

3 Definition of transitive *break/boil* in the Oxford English Dictionary:

(44) a. *to break*: to sever or separate into pieces *by force*
b. *to boil*: to act upon (anything) *by continued immersion in boiling liquid*; to subject to heat *in boiling water*

(46) a. The demolition of the wall caused the basement to flood.
b. #The demolition of the wall flooded the basement.

Thin causatives do not impose similar restrictions on event-denoting subjects, see (47).

(47) a. The accident destroyed her skin.
b. The low air pressure changed the water.

Summarizing, we showed that thick causative verbs differ from thin ones by the restrictions they impose on their subject when used in their physical sense. Thick causatives do not accept subjects that denote an abstract object such as an absence, a fact or a degree, or an event that doesn't instantiate the right manner of causing. What, then, are the syntactic and/or semantic properties that lie behind the thick-thin distinction?

4 Syntax and semantics of English thin vs. thick causative verbs

From recent studies on subtypes of lexical causative verbs, a hypothesis that needs to be discussed is that causatives that we have up to now informally described as 'specifying' or 'conveying' a way of causing *lexicalize* a property of the causing event (rather than a property of the result state; see Embick 2009, Anagnostopoulou 2017, Alexiadou et al. 2017). Verbs discussed in Embick (2009) are all thick causative verbs under our criteria (i.e., they intuitively say something about the way the result is caused, and in their physical sense, they do not welcome subjects with abstract reference). A key syntactic property of the lexical causative verbs isolated by Embick (2009) is their compatibility with strong resultatives, that is, structures such as *hammer the plate flat* or *break the window open*, where the adjective *flat/open* expresses a state not yet expressed by the verb *hammer/break* (see Washio 1997).

To test the idea that the class of thick causative verbs is identical to the class of change-of-state verbs isolated by Embick (2009) (of which *burn* and *break* are two examples), we therefore ran a qualitative corpus survey (see below) on a representative sample of very frequent lexical causative verbs (N = 37) in their concrete sense. For each verb, we look for sentences with an omission or a quality degree in the subject position, and sentences with a strong resultative.

This corpus survey yields two interesting results. First, it shows that the production constraint has to be refined, as data show that omission subjects are occasionally acceptable with thick causative verbs in some conditions. Second, it offers support for the view that causative 'manner' verbs *à la* Embick's (2009) and thick causative verbs largely overlap. But it also disproves the view that lexicalizing a manner property is necessary for a causative to be thick — which has consequences for the cross-linguistic picture, since causative manner verbs may not exist in all languages. Some verbs are thick causatives, but nevertheless categorically reject strong resultatives.

Looking more closely at such verbs (*bury* in our set of 13 thick causatives), we observe that they still specify a way of causing via world-knowledge about the result state they lexicalize.

4.1 Manner vs. result verbs and causative manner verbs

A fundamental division among transitive verbs already mentioned in the introduction is the one developed between manner and result verbs (Levin & Rappaport Hovav 1991, Levin & Rappaport Hovav 2013; see also discussion in Beavers & Koontz-Garboden 2012, Beavers & Koontz-Garboden 2020, Rapoport 2014, Rappaport Hovav 2016). Manner verbs such as *hammer* do not imply any result, and describe a way of acting, see (48a), where the information between angle brackets is provided by the verbal root. These verbal structures can be augmented with a resultative phrase, introducing a state not conveyed yet by the verb itself, as in *hammer flat*. Result verbs are causative verbs; they entail a change of state and encode a state property, but leave the way of acting unspecified, see (48b). (While Levin & Rappaport Hovav decompose causative verbs into ACT, CAUSE and BECOME, we will follow Alexiadou et al. 2015 and many subsequent authors on the view that lexical causative verbs denote a set of events leading to some state).

(48) a. [x ACT$_{<\text{MANNER}>}$]
b. [x ACT] CAUSE [BECOME[y <STATE>] (Rappaport Hovav & Levin 1998: 108)

Levin & Rappaport Hovav (2005: 115) propose that manners act as modifiers of activity (thus non-causative) predicates. This assumption precludes the existence of verbs that lexicalize a way of causing, encode a resulting state but remain silent about this state. That is, verbs following the pattern in (49) are not expected:

(49) [x CAUSE$_{<\text{MANNER}>}$ y STATE]

In other words, there is a very strong link, in this typology of verbs, between encoding a manner component and being a non-causative predicate.

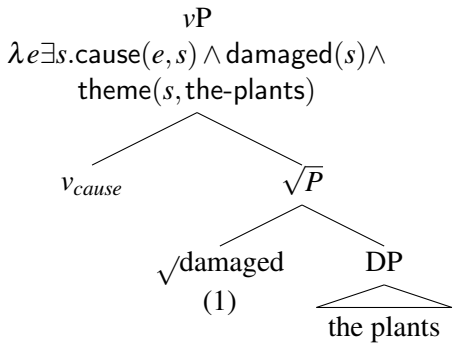
The difference between result verbs and manner verbs can be translated in a non-lexicalist framework, where verbs are assumed to be built in the syntax (Embick 2004, Folli & Harley 2005, Alexiadou et al. 2015). The distinction between these two types of verbs can then be expressed as a distinction betwen types of roots, namely, manner and result roots. For instance, in (50), v_{cause} is the head that verbalizes the structure and introduces the causing event. In *hammer flat*, composed of a manner root and a resultative phrase headed by an adjective, the root $\sqrt{}$*hammer* is adjoined to v_{cause}, thereby specifying *how* causation obtains. The result root $\sqrt{}$*flat* specifies a property of the result state caused by the hammering event. In the case of *damage*, the root specifies a property of the result state, but no 'manner' root is adjoined to v_{cause}. Levin and Rappaport's dichotomy between manner and result verbs is reflected in the fact that the root of result verbs can only appear in position (1) in the verbal structure (the root of result verbs can only be a predicate of states), while the root of manner verbs can only appear in position (2) (the root of manner verbs can only be a predicate of events).

ROOT PROPERTY	thin root	thick root
property concept root	*slow*	
result root	*kill*	*burn*

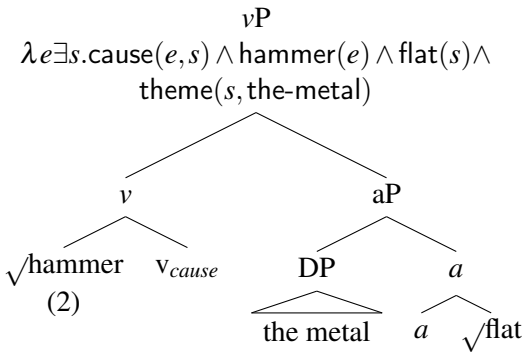
Table 1 Typology of change-of-state verbs based on the property of their root (see Beavers et al. 2021 on the distinction between property concept and result roots)

(50)

(a) damage the plants



(b) hammer the metal flat



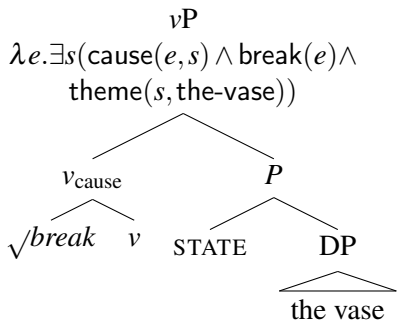
In the recent years, this typology has been argued to be too restrictive. A first line of studies has established that one needs to distinguish across languages between verbs whose root entails a change ('result roots'; see, e.g., *burn, crack, kill, destroy*) and verbs whose root does not entail a change by itself ('property concept roots', Levin's deadjectival classes, e.g., *dry, flatten, lower*); see Beavers & Koontz-Garboden (2017, 2020), Beavers et al. (2017, 2021) among others. This division is not the one we are after, however, since it does not tease apart thick and thin causatives. For instance, *kill* and *burn* are put in the same category of causative verbs whose root entails a change; see Table 1.

A second line of studies initiated by Embick (2009) proposes that the root of certain causative verbs, like *break* or *burn* (but *not kill* or *destroy*), serve as event predicates (see also Anagnostopoulou 2017, Alexiadou et al. 2017, Hopperdietzel 2024). On this view, verbs like transitive *break* or *burn* lexicalize a property of the causing event, thereby instantiating the pattern (49), which is unexpected within Levin and Rappapport's typology. The nature of the state is not specified by the verbal root; rather, it is inferred from the property of the verbal event. For instance, *break* tells us that the state it describes is a state of 'being broken' only indirectly, because it is a state caused by a breaking event; see (51a/b).

(51) a. Yusupov broke the branch.
b. $\lambda e.\exists s(\mathsf{agent}(e,\mathsf{yusupov}) \wedge \mathsf{break}(e) \wedge \mathsf{cause}(e,s) \wedge \mathsf{theme}(s,\mathsf{the\text{-}branch}))$

In structural terms, Embick's (2009) proposal is that verbs like *break* enter the structure in (52). According to this analysis, *break* specifies a property of the causing event, which fits well with our intuition that such verbs specify a way of causing.

(52)



In (53), we give the list of verbs that have been put into the same class as *break* (Embick 2009, Ausensi & Bigolin 2021, Ausensi et al. 2024, Yu et al. 2023).

(53) a. burn, shatter, split, melt, freeze, tear, rip, crush (cf. Ausensi et al. 2024, Yu et al. 2023)
b. break, cut, smash, split (cf. Embick 2009)

One of the main arguments offered by Embick (2009) in favor of an analysis of *break*-roots as predicates of events is that *break*-verbs are compatible with strong resultatives. Strong (as opposed to weak) resultatives are resultative constructions of the *hammer flat*-type, where the state introduced by the result phrase is not introduced by the verb itself yet (Washio 1997). For instance, *flat* in *hammer flat* is a 'strong' resultative, as it describes a state which is not expressed by the verb yet. By contrast, *into pieces* in *break into pieces* is a 'weak' resultative, because *into pieces* only elaborates on the state which is already encoded by *break* itself.

While verbs compatible with strong resultatives tend to be (non-causative) manner verbs like *hammer* (Levin & Rappaport Hovav 1991, Rappaport Hovav & Levin 1998, 2010), Embick and others after him observe that a subset of result (change-of-state) verbs, like *burn*, *melt* or *break*, are also compatible with strong resultatives; see also Ágnes Farkas 2009, Ausensi & Bigolin (2021), Ausensi et al. (2024), Yu et al. (2023). For instance in (54b), *open* expresses a state which is not lexicalized by *break* itself, differently from what happens in the case of *break into pieces*. Verbs like *destroy* or *damage* do not combine with strong resultatives, see (55).

(54) a. Once you're dead, the Warrior will burn this planet clean![ex15]
b. John broke/ cut/ smashed the box open. (Embick 2009: 17)
c. The twisting of the hull broke free a few interior stay cables inside the hull.[ex16]

(55) a. *Once you're dead, the Warrior will destroy this planet clean!
b. *Kara damaged free the brass fixtures that were mounted in the shower.

For Embick (2009), the compatibility with strong resultatives is the hallmark of causative verbs that predicate a property over an event (rather than a state). They can take a stative complement precisely because the verb itself does not lexicalize a property of state. This property is either lexically projected (as in *burn clean*) or remains implicit, and is inferred from the event property

(e.g. *broken* in the case of *break*); see also Anagnostopoulou (2017), Alexiadou et al. (2017). We will call these verbs *causative manner verbs*.

4.2 Corpus survey

If the class of thick causatives is identical to the class of causative manner verbs, we expect the same verbs to both accept strong resultative structures and reject subjects with abstract reference (when used in a physical sense). Similarly, if the class of thin causative verbs (*destroy, damage*) is identical to the class of run-of-the-mill (non-manner) causatives, we expect the same set of causatives to both accept subjects with abstract reference (when taken in a concrete sense), and to be incompatible with strong resultatives, since result phrases that introduce states distinct from the state introduced by the verb are disallowed (Rappaport Hovav & Levin 1998, 2010; see also discussion in Ausensi et al. 2023).

Testing the expected correlation on the basis of previous studies is not possible, for the verbs examined there are very few and all express the same kind of changes–a loss of integrity (*break, split*, etc) or a change of consistency under a change of temperature (*freeze, melt*). To test it and more generally identify the contours of the thick-thin distinction, we therefore need to establish a representative list of causative verbs.

4.2.1 Verbs at study

For the corpus survey, we constructed a list of causative verbs that prevents us from cherry-picking predicates that plausibly obey the expected correlation, and which is also representative enough of the class of verbs under investigation.

To build this list, we first selected the 1000 most frequent English verbs (via a frequency query on the Ententen21 corpus from Sketchengine, see Kilgarriff et al. 2014). From this list, we only kept change-of-state verbs (through a manual selection informed by studies in lexical semantics such as Levin 1993, Levin & Rappaport Hovav 1995, Alexiadou et al. 2015, Beavers & Koontz-Garboden 2020 among others). Since we are only interested in causative verbs that express concrete, physical changes (as by assumption, it is only under the literal meaning of causative verbs that P-CAUSE is preferred to D-CAUSE), we discarded psychological and/or modal causative verbs (e.g., *bother* or *forbid*). The latter typically do not describe transfer of force or energy even with a subject that has superficially concrete reference, and as a result should not favor P-CAUSE in any context.[4]

From the remaining 162 verbs, we kept verbs that appear more than 1 million times in Ententen21 (94 verbs), because the next steps involved time-intensive careful inspection of corpus data for each verb. From this list, we manually extracted verbs satisfying two criteria. The first one is the compatibility with an object denoting a concrete entity, in order to ensure that the verb can convey a transfer of energy from the subject's referent to the object's referent. For instance, verbs like *increase* or *double* were discarded, since the nominal in object position is not individual-denoting, but rather denotes a function applying to an object x (the possessor) and to a time t, yielding the

4 On the idea that the subject argument of object experiencer verbs has abstract reference even under the guise of a concrete nominal, see for instance Bott & Solstad (2014: section 3.2.1), Bouchard (1995: 359) and Kim (2024).

quality (or intensity, number, etc.) of *x* at *t* (on these verbs, see Bartsch & Vennemann 1972, Schäfer 2024).[5] The causal relation expressed by such causative statements never amounts to a transfer of energy between the subject's and object's referent, since functions are not energy recipients.

(56) a. This doubled the road accidents.
b. ≈ This doubled the number of road accidents.

The second criterion is the compatibility with eventive and non-agentive subjects. Verbs that require an agentive subject are obviously not able to combine with fact-denoting subjects for independent reasons. 83 verbs fulfilled these two criteria.

We also aimed to control whether the participation to the causative alternation influences the selectional restrictions on the subject. Therefore, participation to this alternation was considered to be a relevant criterion, too. Two linguists assessed whether the 83 verbs can be both used transitively and intransitively with a prototypical concrete object. We kept the 52 verbs for which inter-annotator agreement was obtained. For these 52 verbs, we verified our previous judgments with regard to the compatibility with a concrete object and an inanimate and non-agentive subject against corpus searches, examining whether we could find examples where the verb is combined with a non-agentive DP in subject position and simultaneously have an individual-denoting object. [6]

The resulting list consisted in 37 verbs. For each of these verbs, we decided *a priori* whether it intuitively specifies a way of causing when combined with an inanimate subject and a concrete object (i.e., whether it is thick or thin). We assessed our intuitions on the basis of questions as in (57), built with two pronominal arguments carrying a non-human feature, in order to abstract away from any specific argument and invite to focus on the information carried by the verb without the influence of lexical cues from the arguments. The assumption is that in such contexts, lexical causative statements built with a thick causative will be perceived as specifying ways of causing, and this more than the periphrastic causative statements, since overt causatives like *cause* carry no information whatsoever on ways of causing.

(57) Does sentence (a) specify the way the subject changed the object? Does it do it more than the corresponding sentence (b)?
a. This burned/changed it.
b. This caused it to burn/change.

For these 37 verbs, we inspected their definitions in the Merriam-Webster Dictionary and the Cambridge Dictionary to check whether they contain an indication of way of causing when they

5 We kept verbs like *change* that pattern with *increase* in some of their uses but not all (*change* can also be used as a synonym of *replace*, for instance).

6 The verb *delete* is an example of verbs we first mistakenly kept in our working list. Looking at corpus data, we realized that when the subject of this verb is inanimate, it typically has agentive properties. This is confirmed by the list in (`[ld]`) of the most frequent inanimate subjects found on EnTenTen21, which often have an instrumental (and thereby agentive) semantics, such as *command, function, procedure, program*. On inanimate agents in natural language, see Cruse (1972), DeLancey (1991), Schlesinger (1989), Folli & Harley (2007), Alexiadou & Schäfer (2006), Fauconnier (2012).

are used as transitive verbs.[7] This information confirmed our pre-classification for the majority of verbs: at least one of the dictionaries provides manner information for verbs we intuitively classified as thick (see Table 2), and they do not provide manner information for most verbs identified by us as thin. There were some exceptions, however. We preclassified *dry, cool, lift* and *mix* as thick, but the definitions of these verbs do not specify any way of causing. We concluded that we had misclassified *dry* and *cool* and put them in the set of thin causative verbs. But we kept *lift* among thick causatives, as it intuitively implies the use of effort or force (see also Glass 2021 on what she calls the 'manner' meaning of *lift*).[8] We also kept *mix* among thick change-of-state verbs, since this verb invokes blending scenarios with similar instruments as *stir* or *beat* (Gentner 1978). Also, we have ignored the information provided in the Merriam-Webster Dictionary for 4 out of the 24 verbs that we have identified as thin causatives, because it clearly does not seem to infuse the lexical semantics of the verbs in question.[9]

The final list is given in Table 3, with 13 thick verbs and 24 thin ones. The 37 verbs instantiate 16 different classes in Levin's (1993) typology (despite being extremely frequent, 7 of these verbs are not listed in Levin 1993).[10] In particular, the 13 thick verbs instantiate 9 different verb classes, that is, 7 more than the ones looked at in by Embick (2009), Ausensi & Bigolin (2021) and Ausensi et al. (2023). Among the 37 verbs, 6 are deadjectival verbs (all zero-derived except for *lower*), and these 6 verbs are all thin.[11] 19 enter the causative/anticausative alternation, 15 are inherently

7 The decision to use these dictionaries rather than the Oxford English Dictionary was motivated by the fact that the former offer concise definitions of the verb's main meanings, whereas the OED provides a very exhaustive overview of all its meanings, in which there was a risk of getting lost.

For some of the thick verbs in our list, previous work in lexical semantics has already observed that these verbs encode more manner information than verbs like *kill*. For instance, *cut* has been argued to entail the use of a cutting device (Brousseau & Ritter 1991), or a sharp (-bladed) too (Rapoport 2014). After Tobin (1993: 222–245), McMillion (2006: 122) contrasts *close* with *shut* in that while with the first, the resultant state is salient, with the second, the process itself is salient, which is expected if *shut* encodes a way of causing. Shibatani (1976: 31) describes *drop* as entailing manipulative causation. Rapoport (2014) proposes that *melt* and *break* involve manner information ('heat means' for *melt* and 'forceful means' for *break*).

8 This intuition is confirmed by ChatGPT. Asked to delineate the difference between *lift (a table)* and *raise (a table)*, it answers that *lift* implies using effort, force, or the hands, or another supporting means.

9 These four verbs are found below; we put in italics the manner information provided for one of their specific senses by the Merriam-Webster dictionary:

(58) a. close: to make complete *by circling or envelopin*g or *by making continuous* (*close a circuit*)
b. open: to make available for entry or passage *by turning back* (something, such as a barrier) *or removing* (something, such as a cover or an obstruction), to bring into view or come in sight of *by changing position*
c. stop: to close *by filling or obstructing* (*stop the drain*)
d. trigger: to release or activate *by means of a trigger* (*trigger a rifle*)

10 Levin (1993) lists *waken*, but not *wake*.

11 The fact that none of the deadjectival verbs is thick (see the empty cell in Table 1) fits well with Beavers et al.'s (2017) idea that the root of deadjectival verbs does not entail a change on its own. Indeed, under the hypothesis that the root of thick causative verbs lexicalizes a property of the causing event (or change), these verbs necessarily entail a change on their own. The existence of thick deadjectival causative verbs is for this reason a priori unexpected.

verb	Merriam-Webster	Cambridge
break	with suddenness or violence	by force
burn	by fire	by fire, heat, acid
bury	by covering with earth	–
cut	with an edge instrument	using a sharp tool, especially a knife
drop	with a shot or a blow	intentionally or unintentionally
lift	–	–
lock	with or as if with a lock	with a key
melt	usually by heat	usually by heating
mix	–	–
shut	by enclosure, or covering parts together	–
spread	by weight or force	–
stretch	by force or by physical force	by pulling
switch	with or as if with a switch	to use a switch

Table 2 Specifications of ways of causing for causative verbs in the Merriam-Webster and Cambridge dictionaries

transitive (we come back to the influence of the thick-thin distinction on this alternation in the conclusion).

4.2.2 Method

For the 37 verbs at study, we assessed the compatibility with adjectival strong resultatives, omissions and quality denoting subjects through corpus searches in the EnTenTen21 corpus. Given that these verbs are extremely frequent and the EnTenTen21 corpus very large (131,222,868 words), it seems reasonable to consider natural occurrences that are acceptable to our ears as a proof of compatibility with the structures under investigation, and the absence of natural occurrences as a reliable indicator of incompatibility with the same structures. Nevertheless, in the absence of positive results, we extended the search to other corpora.[13] We conducted our queries in CQL (Corpus Query Language, the language provided by Sketch Engine for advanced searches; see the Appendix). Hits found by the queries were then evaluated manually. To assess the compatibility of the verb in a concrete meaning with a fact-denoting subject, we only considered examples in which the verb instantiates a physical meaning and furthermore discarded idiomatic (figurative) expressions. Examples such as (59) are considered irrelevant, since the verb is used non-literally.

13 For strong resultatives, we limited our search to adjectival resultatives (*He broke it open*). We did not investigate resultatives headed by a preposition (*The fire burned the paper into ashes*), and this for three reasons. Firstly, there is no clear reason to think that certain causative manner verbs enter strong resultative constructions only when headed by a preposition; looking at adjectival ones should be sufficient. Secondly, prepositional phrases that look like resultatives sometimes turn out to be adjuncts (see Bigolin & Ausensi 2021, Mateu 2012 a.o.).

#	verb	alternating	verb types in Levin (1993)	thick	ASR	omission or quality subjects
1	*activate*	Y	*not listed*	N	N	Y
2	*affect*	N	*amuse* verbs	N	N	Y
3	*change*	Y	*turn* verbs	N	N	Y
4	*close*	Y	cos verbs (others)	N	N	N[12]
5	*cool*	N	cos verbs (others)	N	N	Y
6	*damage*	N	*not listed*	N	N	Y
7	*destroy*	N	*destroy* verbs	N	N	Y
8	*dry*	Y	cos verbs (others)	N	N	Y
9	*eliminate*	N	verbs of removing	N	N	Y
10	*enhance*	N	*not listed*	N	N	Y
11	*extend*	Y	verbs of existence	N	N	Y
12	*hurt*	N	*hurt* verbs	N	N	Y
13	*kill*	N	verbs of killing	N	N	Y
14	*lower*	Y	verbs of putting	N	N	N
15	*open*	Y	cos verbs (others)	N	N	Y
16	*put*	N	*put* verbs	N	N	Y
17	*restore*	N	contribute verbs	N	N	Y
18	*set*	N	*put* verbs	N	Y*	Y
19	*slow*	Y	cos verbs (others)	N	N	Y
20	*start*	Y	aspectual verbs	N	N	Y
21	*stop*	Y	aspectual verbs	N	N	Y
22	*trigger*	N	*not listed*	N	Y*	Y
23	*turn*	Y	*turn* verbs	N	Y*	Y
24	*wake up*	Y	*not listed*	N	N	Y
25	*break*	Y	break verbs	Y	Y	N
26	*bury*	N	*not listed*	Y	N	N
27	*burn*	Y	hurt verbs	Y	Y	Y
28	*cut*	N	break verbs	Y	Y	N
29	*drop*	Y	verbs of calibratable cos	Y	Y	N
30	*lift*	N	verbs of putting	Y	Y	Y
31	*lock*	Y	tape verbs	Y	Y	Y
32	*melt*	Y	cos verbs (others)	Y	Y	Y
33	*mix*	Y	mix verbs	Y	Y	N
34	*shut*	Y	cos verbs (others)	Y	Y	N
35	*spread*	Y	verbs of existence	Y	Y	N
36	*stretch*	Y	verbs of spatial configuration	Y	Y	N
37	*switch*	Y	*not listed*	Y	Y	N

Table 3 Results of the corpus survey (ASR = adjectival strong resultative; 'Y*' indicates that the verb is compatible with an ASR but does not lexicalize a state by itself).

(59) This lack of empathy burns me up.[ex17]

4.3 Results and discussion

The findings of the corpus survey are summarized in Table 3 (relevant data can be found in the Appendix). The tendency observed in the data is the one expected. Most thick causative verbs (12/13) are found with adjectival strong resultatives (ASR), and are not found with quality or omission subjects when they are used in their concrete sense.[14] Furthermore, for most thin causative verbs (22/24), we found examples with an omission or a quality subject when these verbs are used in a concrete sense, and we found no examples with a strong resultative, unless the verb does not introduce a result state by itself, just like *cause*; see e.g. *trigger*.[15]

Still, we do find verbs in our list that do not behave as expected. A minor issue is raised by *lower* and *close*, which we did not find with omission or quality subjects when used in a concrete meaning in a non-idiomatic expression.[16] Other relevant subcases are more interesting and addressed in turn in the next subsections.

4.3.1 Omissions and qualities with thick causatives

Revealing exceptions to the expected correlation are found with the thick causative verbs *burn*, *lift* and *lock*, which are occasionally found in corpora with absences; see for instance the natural occurrences in (62).

(62) a. It's very easy with some plants to know what happened to them. Sludge like anything? Cold got them. Burn without yellowing first? Lack of humidity burned them.[ex20]
b. NEVER LET THE FOUNTAIN RUN DRY!!! Lack of water will burn out the pump.[ex21]

14 These verbs remain compatible with ASRs when they are taken in a non-literal sense; see for instance (60). We take this to indicate that these verbs still lexicalize a manner of causing when they are used non-literally, what is in line with the assumption that verbs keep their core syntactic properties in figurative uses (McNally & Spalek 2022).

(60) a. Turning the Hobbit book into three films stretches these characters thin in terms of personality.[ex18]
b. It seems to really irritate people if they can't hear the words. We mixed the voice hotter on this one.[ex19]
c. There shall come a time, I think, when humanity sees itself reflected, and burns the darkness clean.

That we do not find deadjectival verbs with strong resultatives also confirms previous claims; see Embick (2009) and Yu et al. (2023: 1604): "[...] property concept [=adjectival] roots cannot appear in resultative structures where another property concept root or a stative constituent is in the complement of v_{cause} position."

15 The thin verbs found with adjectival strong resultatives are *set, trigger* and *turn*. As illustrated in (61), the resultative is in fact compulsory with these verbs (the motion sense of *turn* is irrelevant here).

(61) a. Your presence triggers the door *(open).
b. He set me *(free).
c. It turned it *(red).

None of these causative verbs introduce a result state. Their root arguably spells out v_{cause}. Therefore, the result node remains empty and must be occupied by the resultative. In that respect, these cases are not exceptions to the expected correlation.

16 These verbs are found with absences but with an object describing a degree (*The lack of O2 lowered the pH of the water*) or are used in an abstract (institutional) sense (*The lack of anesthetics closed the operating rooms*).

c. The lack of oxygen burning her lungs and her throat begging to release the air trapped inside [...][ex22]
d. The lack of suspension lifts the other wheels up.[ex23]
e. The research shows that what is believed to be required to increase the superconductivity in these systems – stronger magnetic interactions – also pushes the system closer to the 'quantum traffic-jam' status, where lack of holes locks the electrons into positions from which they cannot move.[ex24]

While these examples are far from frequent, they are still natural to our ears, which raises a question: how to reconcile them with Rose et al.'s (2021) experimental data? Some of these data are repeated in (63) below.

(63) a. The lack of sunscreen burned Jane's skin.
b. The lack of sealant cracked the driveway.
c. The lack of a heat shield melted the rubber gasket.
d. The lack of a basement flooded the cellar.

We think data in (62) and (63) exhibit two interesting differences that reduce the contradiction. A first one is that in (62), but less in (63), the omission description can be interpreted as the description of an eventuality, much like negative event descriptions (*I saw him not watering the plants*) can be interpreted as descriptions of events (Stockwell et al. 1973, Higginbotham 2000) or states (Asher 1993, Kamp & Reyle 1993, de Swart & Molendijk 1999); see discussion in Fábregas & González Rodríguez (2020).

For instance in (62a/b), "lack of humidity/water" can be a way to describe drought; in (62d), "lack of suspension" can describe a fixed-wheel set up. Once the subject in (62) is reinterpreted this way, it can denote a productive cause.

Such a positive redescription of the omission is perhaps not impossible in (63), but there is a second difference between attested examples in (62) and constructed items in (63) that makes the latter still less natural than the former. This difference concerns the causal factors involved apart from the omission/eventuality named in subject position. In examples (63), an implicit cause obviously intervenes between the omission and the reported change-of-state: the sun in (63a), the heat in (63b/c), water in (63d).[17] Symptomatically, the subject of all these examples describes a lack of *protection* against this implicit production cause. It is basically this additional implicit cause which is the transference cause fitting the way of causing specified by the verb, *not* the subject's referent. Things are different in (62): drought itself can 'produce' the new condition of the plants or the pump; the fixed-wheel set up can itself 'produce' a movement in the other wheels. That is, in (62), but not in (63), the subject's referent can be the most salient transference cause aligning with the way of causing conveyed by the verb, although it appears under the superficial guise of an omission description.

Thus, the constructed experimental items in (63) are worse than the natural examples in (62) because the former still violate the production constraint even if the DP is interpreted as an

17 The additional causal factor was always salient in the experimental context since it was named explicitly in other test sentences (such as e.g. *the dry climate cracked the driveway* in the case of (63b)).

eventuality description, in that even so reinterpreted, the subject does not name yet the production cause that fits the manner information of the verb, but rather a lack of protection against this implicit cause.

This also means that we have to refine the production constraint thick causatives must abide by: what is required is a transfer of physical quantities between the production cause *named by the subject* and the entity named by the object; see (64):

(64) PRODUCTION-BASED CAUSATION CONSTRAINT: Taken in their physical sense, thick lexical causative verbs (preferably) convey a transfer of conserved physical quantities between the entity denoted by the subject (the causer) and the entity denoted by the object (the causee).

Such a transfer possibly takes place in (62), but not in (63), and this even if the subject is reinterpreted as the description of a positive condition.

That being said, the corpus examples (62) remain more marked than their counterparts with *cause* precisely because they require to be acceptable a reinterpretation process of the subject DP. Such a reinterpretation is not needed with thin causative verbs. We can show this with 'rigid' fact-denoting subjects that block the reinterpretation process, like for instance *the fact that...*. For instance, while (65a) is difficult to salvage to our ears, (65b) is fine (in the formal register required by such subjects). As we will propose in section 5, this is because *destroy* does not favor P-CAUSE over D-CAUSE like *crack* does.

(65) a. #The fact that my lips lack hydration cracks them.
b. The fact that my lips lack hydration destroys them.

A coercion process is also at play with other exceptions to the expected correlation found in corpus data. Relevant examples are built with a thick causative and a subject which is superficially degree- or fact-denoting, like *the intensity of the fire*; see (66).

(66) a. When they found the burning car it was noted that the rear doors were chained shut, but the intensity of the heat melted the door handles and allowed the rescuers to open the car.[ex25]
b. The intensity of the fire lifted the radioactive contaminants higher into the atmosphere, leading to widespread contamination throughout Europe, Asia, and the northern hemisphere.[ex26]

To our ears, such examples are infelicitous in their literal reading; the subject DP needs to be reinterpreted to denote the possessor of the quality (e.g. *the intense fire* in (66b)) in order for them to be acceptable.

To summarize, the corpus examples discussed so far are not real exceptions to the hypothesis that thick causatives tend to require their inanimate subject to denote a production cause of the denoted change. The difference in acceptability between natural examples (62) and constructed examples (63) of thick verbs with omissions revealed that subjects superficially denoting an absence can be reinterpreted as descriptions of a productive cause under certain conditions.

4.3.2 Thick causatives that are not manner verbs

The corpus survey also served to check whether all causative verbs identified as thick are causative manner verbs, what we diagnose via the compatibility with strong resultatives. Most thick causative verbs (11/12) were indeed found in combination with strong resultatives. The verb *bury* is an exception, however. *Bury* was never found in combination with omission or quality subjects in corpora, but also not with adjectival strong resultatives, what seems to reveal a genuine syntactic property of this verb. For instance, *dead* in (67) cannot be interpreted as expressing a result of the burying event, although this interpretation is in principle plausible.

(67) They buried him dead.
cannot mean: they buried him and as a result he was dead.

The thick causative verb *bury* is therefore not a causative manner verb. What that means is that causative verbs can in principle specify a way of causing without *lexicalizing* this manner into an event predicate, like *burn* does under Embick's (2009) analysis of such verbs. But then, how do verbs 'specify' a way of causing, if not by lexicalizing an event (manner) property via their root?

We think that the *nature of result states* lexicalized by thick causatives like *bury* reveals something about the productive cause that generated them. These verbs lexicalize a property of a state, but in addition allow to conclude something about the production cause behind this state. A state of being buried indicates that the process leading to it involves getting covered with soil or something similar.

States expressed by thin causatives, on the other hand, tell us nothing about the process that generated them. For example, a state of being dead or destroyed does not indicate anything about the causing event leading to it.

In other words, thick causative verbs may tell something about the productive cause not only by *lexicalizing a way of causing* (only the subject of manner thick causatives do so), but also by lexicalizing a property of states whose nature reveals certain properties of the productive cause that yielded them. We can call 'thick' the predicates of states that encode traces of ways of causing (e.g. *buried*), and those that do not 'thin' (e.g. *destroyed, damaged*).

The fact that thick causative verbs do not need to be manner verbs is important for the cross-linguistic picture. Indeed, some languages may not have causative manner verbs. Take for instance verb-framed languages like French or Spanish. It has been extensively argued that in these languages, every verb in a change-of-state construction must lexicalize the result; on this view, causative manner verbs in such are languages are not expected (Talmy 1991, 2000; Folli & Harley 2020).[18]

For such languages, we should nevertheless still observe the same restriction over fact-denoting subjects for causative verbs lexicalizing a thick stative property. And indeed, in a language like French for instance, omissions are to our ears infelicitous with thick causatives; see e.g. (69), built

18 In the same vein, Ausensi et al. (2023) argue that the roots of the Spanish counterparts of *break*-verbs are not eventive, but stative. That is, for them, while the root of *melt* denotes a relation between individuals and events, the root of Spanish *fundir* 'melt' denotes a relation between individuals and states.

with *brûler* 'burn' or *inonder* 'flood', although the problem seems more attenuated than in English, a point we come back to in the conclusion.[19]

(69) a. ?*Le manque de crème solaire lui a brûlé la peau.*
the lack of sunscreen her has burned the skin
'The lack of sunscreen burned her skin.'
b. ?*L'absence de mur protecteur a inondé la cave.*
the absence of well protective has flooded the basement
'The absence of protective wall flooded the basement.'

In summary, most of the thick causative verbs in our corpus survey are causative manner verbs, but not all. Lexicalizing an event property is thus not necessary for a causative verb to convey a way of causing. This can be done either by verbs whose root lexicalizes an event property, see (51) repeated below, or by verbs whose root lexicalizes a state property that tells us something about the way it was caused, see (70).

(51) a. Yusupov broke the branch.
b. $\lambda e.\exists s(\mathsf{agent}(e,\mathsf{yusupov}) \wedge \mathsf{break}(e) \wedge \mathsf{cause}(e,s) \wedge \mathsf{theme}(s,\mathsf{the\text{-}branch}))$

(70) a. Yusupov buried the money.
b. $\lambda e.\exists s(\mathsf{agent}(e,\mathsf{yusupov}) \wedge \mathsf{cause}(e,s) \wedge \mathsf{buried}(s) \wedge \mathsf{theme}(s,\mathsf{the\text{-}money}))$

5 Why are thick causative verbs allergic to subjects with abstract reference?

Now that we have a clearer picture of the lexical properties that distinguish thick and thin causatives, we can turn back to our original question: why are thick causative verbs allergic to subjects with abstract reference? The explanation cannot just be that causative statements built with thick causative verbs exclusively encode P-CAUSE. The data reviewed earlier informed us that thick causatives are

19 These two verbs specify a way of causing in French like in English; for instance, *Le petit Robert* dictionary defines *brûler* 'burn' as destroy *by fire*, and *inonder* 'flood' as cover *with water or liquid.*

The examples of omission subjects with French thick causative verbs we found in corpora are as in English also reinterpretable as denoting a production cause; see for instance the examples (68) below, where *l'absence d'eau* can be reinterpreted as referring to drought.

(68) *D'après lui, l'absence d'eau a brûlé les feuilles et interrompu la croissance de la plante*
according to him the lack of water burned the leaves and interrupted the growth of the plant
en ne permettant pas à la sève de s'écouler normalement.
in NEG allowing NEG to the sap from REFL.flow normally
'According to him, the absence of water burned the leaves and stopped the plant's growth by preventing the sap from flowing properly.'

compatible with fact-denoting subjects when they are used in an abstract sense, or when they are used in a concrete sense but as intransitive (anticausative) verbs; recall (14). Since facts can serve as relata of D-CAUSE but not P-CAUSE, this means that D-CAUSE can very well be conveyed by causative statements constructed with a thick change-of-state verb.

5.1 The competition between covert and overt cause

We propose to account for the preference for P-CAUSE over D-CAUSE when causative manner verbs are used in their physical sense as follows. The operator CAUSE that makes part of the semantics of lexical causative statements is the same operator as the one spelled-out by the verb *cause*: it can convey both P-CAUSE and D-CAUSE. The preference for P-CAUSE when a thick causative verb is used in a concrete sense results from the combination of two factors:

i. The manner information makes the P-CAUSE meaning a salient alternative. For instance, physical *burn* tells us that fire is involved, and in that sense makes energy transference salient. (The productive meaning is not emphasized when thick causatives are used in an abstract sense – in fact, it is *de*-emphasized, since physical forces are obviously not involved in the abstract causal chains conveyed by these verbs taken figuratively).[20]

ii. When there is a competition between a lexical and a periphrastic causative form to express a situation of the same complexity (i.e. involving the same number and type of participants), the lexical (morphologically more constrained) form tends to pick up the more specific meaning, which is P-CAUSE if both P-CAUSE and D-CAUSE are potential candidates (under the abstract meaning of thick verbs, D-CAUSE is the only candidate).

The P-CAUSE meaning is more specific/stronger than the D-CAUSE meaning because the former asymetrically entails the latter: if *x* P-CAUSES *y*, then *x* necessarily also D-CAUSES *y*, but the reverse is not true (since *x* may very well D-CAUSE *y* without transferring energy to *y*). Relatedly, p-causes must be physical, energy-inducing entities (events, people, machines, etc), while d-causes can be of any type.

This division of semantic labor, where the more special/less productive form tends to pick up the most specific meaning, has repeatedly been observed elsewhere (in the domain of derivational processes, see Kiparsky 1982 and Blutner & Solstad 2001 on partial blocking; see also McCawley 1978 on the lexical/periphrastic competition discussed in more detail in the section 6). For instance, *sing* tends to pick a more specific meaning than *produce a series of sound* (Grice 1989, Van Rooy 2004). And the same way *produce a series of sound* tends to preferably pick up situations that are not expressed by *sing* (although it strictly speaking can convey them too), *cause to burn* tends to be interpreted as denoting another meaning than physical *burn*, namely D-CAUSE (although *cause to burn* can convey both D-CAUSE and P-CAUSE, cf. Rose et al. 2021). As a result, *cause* may turn infelicitous if the point of the utterance is to describe a production cause. Imagine, for instance,

20 This does not mean that thick causatives loose their manner information when used figuratively; simply since this manner information is also taken figuratively (fire as evoked by *burn my soul* reflects a psychological combustion), it does not promote P-CAUSE as it does in the literal meaning.

that the head chef asks his assistant what stage Mary has reached in the making of the chocolate cake. Even if we assume the assistant to be pedantic to satisfy the formal register required by *cause*, it would still be a bit awkward for the assistant to describe Mary' action by means of (73a). Note that this is true independently of whether Mary did that by manipulating the chocolate herself, or forced/asked someone to (help her to) do so (we come back to the directness constraint in the next section). For us, this is because *cause* tends to specialize in the expression of causal dependence, whereas the point of the utterance is here just to give a picture of the transference cause Mary was involved in.[21]

(73) a. One minute ago she caused the chocolate to melt.
b. One minute ago she melted the chocolate.

By contrast, if the point of the utterance is to establish a dependence relation between events, and clearly *not* to report the occurrence of a transfer of energy of such or such type, overt *cause* is at least as natural as the corresponding lexical causative, and this even in the absence of intervening event. For instance, in a legal report, (74a) is at least as (if not more) appropriate as (74b), and this while the heating 'produces' the melting without the intervention of an intermediate cause.

(74) a. The investigation has established that the heating system in question caused the plastic storage containers to melt, and accordingly that the heating company's liability is fully established in relation to all damages flowing from said malfunction.
b. The investigation has established that the heating system in question melted the plastic storage containers, and accordingly that the heating company's liability is fully established in relation to all damages flowing from said malfunction.

To summarize, thick causative verbs specialize in the expression of productive causation as a result of the pragmatic competition with overt causative verbs, and as a result, *cause* tends to express what is not yet covered by the corresponding thick lexical causative.

21 Note that in the same context, the contrast is even stronger in a progressive sentence:

(71) a. ?She was causing the chocolate to melt.
b. She was melting the chocolate.

This is not the single property that *cause* shares with achievement verbs (Vendler 1967, Piñón 1997): it also combines rather poorly with agent-oriented adverbials, see (72a), as well as with aspectual verbs, see (72b):

(72) a. She cautiously/carefully/patiently melted the chocolate/?caused the chocolate to melt.
b. She stopped melting the chocolate/?causing the chocolate to melt.

The aspectual profile of *cause* is another confirmation that this verb is not the perfect match to report a productive cause: it is not what Ryle (1949) calls a "task verb" describing an ongoing activity, what probably contributes to explain why it is not used very often in common speech as reported in Rose et al. (2025).

Yet, since thin causative verbs do not specify properties of the production cause behind the change they express, the P-CAUSE meaning does not get promoted, which leaves the way open for subjects with abstract reference.[22]

5.2 The anticausative of thick causatives

This specialization in the expression of P-CAUSE due to the competition between lexical and periphrastic forms does not arise when the causative statement is formed with an anticausative verb combined with a causer prepositional adjunct, as in (14a) repeated below under (75).

(75) The vase broke from/due to a lack of proper packing.

There are several reasons for this. First, the intransitive verb does not compete with the periphrastic construction, since they do not express the same number of arguments. Second, the intransitive verb describes the change only, and not the full causation event. It therefore does not contain CAUSE in its lexical representation.[23] Rather, CAUSE is introduced by the preposition of the causer-PP adjunct (the *from/due to* phrase in (63)), whose meaning restrictions, if any, do not depend on the lexical semantics of the verb. Thirdly, and relatedly, the event predicate encoded by thick verbs is interpreted differently in an intransitive construal than in a transitive one, since events in the extension of the anticausative are just changes. In particular, this event predicate is not interpreted as conveying information about the way of causing when the verb is used intransitively. To take the example of *burn*, the manner information offered in the Merriam-Webster dictionary for the transitive use ('to destroy something *by fire*') becomes information about ways of *changing* rather than *causing*, e.g., 'to undergo combustion', 'to contain fire'. In other words, the selectional restrictions that thick causatives impose on the causer logically disappear once the causer is not syntactically projected, and the 'manner of changing' that is primarily conveyed by the verb in the intransitive construal can be fulfilled by the theme independently of whether the causer expressed by the causer PP is a concrete or abstract entity.

For all these reasons, causative statements expressed with thick change-of-state verbs used as intransitives and a causer PP are not constrained in the same way as causative statements constructed with their transitive counterparts.

6 Production entails directness

A last question concerns the link between the production constraint associated with thick lexical causatives in their concrete sense, and the well-known directness constraint often associated with lexical causative verbs in general (McCawley 1978, Wolff 2003, Shibatani 1976, 2002, Bittner 1998, Piñón 2001, Van Rooy 2004, Benz 2006 among others). The latter constraint says that the

22 As discussed in section 6, thin lexical causative verbs may still compete with overt *cause* in other ways.

23 In lexical frameworks, CAUSE is usually assumed to be part of the transitive meaning of change-of-state verbs only (see e.g. Parsons 1990, Levin & Rappaport Hovav 1995), and in a neo-constructionist framework, it is the Voice head that conveys CAUSE in the verbal structure (Folli & Harley 2007, Martin et al. 2025). We take this functional head not to be part of the verbal structure in intransitive construals (Folli & Harley 2005,Wood & Marantz 2017, Martin et al. 2025).

causal relation expressed by lexical causatives must be direct, while the one expressed by overt causatives can also be indirect (and in fact tends to be so, as a result of the competition between covert and overt causatives; cf. McCawley 1978, Rett 2020). Direct causation has been defined in many ways (partly collected in Wolff 2003: 4):

- direct or high degree of control (Smith 1970, Brennenstuhl & Wachowicz 1976)
- intentional causation (DeLancey 1983, Kiparsky 1997);
- absence of intervention of another agent (Cruse 1972), force (Verhagen & Kemmer 1997) or event (Rappaport Hovav & Levin 1999, Bittner 1998, Kratzer 2005, Levin 2020, Nash & Bhatt in press) in the causal chain between causer and causee;
- physical contact between causer and causee (Wierzbicka 1975, Gergely & Bever 1986, Pinker 1989);
- physical manipulation (Shibatani 1976)
- unmarked (e.g. intentional) causative situations (McCawley 1978).
- causal sufficiency (Martin 2018, Baglini & Bar-Asher Siegal 2025)

Among linguists, a popular definition is the one provided in Wolff (2003), repeated in (76).

(76) Direct causation is present between the causer and the final causee in a causal chain (i) if there are no intermediate entities at the same level of granularity as either the initial causer or final causee, or (2) if any intermediate entities that are present can be construed as an enabling condition rather than an intervening causer. (Wolff 2003: 4-5)

Rose et al. (2021) do not clarify the conceptual relationship between the production constraint and the directness constraint. Do we deal with two unrelated constraints with potentially additive effects? Are the two constraints two sides of the same coin?

Our view on the matter is twofold. First, we think that production is actually the deeper story about why *some* lexical causative verbs must obey the directness constraint as defined in (76). Indeed, when verbs express productive causation, they automatically abide by some directness constraint: for a transfer of energy to happen between the causer and the causee, physical contact or the absence of intervention of an additional cause is often required. (Also, if e 'produces' e', e is more likely to be a sufficient cause for e'). In a sense, the production constraint is the positive version of the directness constraint when it is negatively defined by the absence of intermediate entities as in (76).

Our second point concerns the scope of the directness constraint across the lexicon. For Wolff (2003), all causative verbs obey the directness constraint under his definition (76). He acknowledges the existence of potential counter-examples such as (77), and accounts for them via a 'granularity restriction' (the chains of events described in (77) are indeed complex, but the intermediaries are not at the same level of abstractness as the causer and causee, and thus do not count as true intermediaries).

(77) a. William the Conqueror changed the English language (by occupying England in 1066). (Wolff 2003: 33)
b. The eclipse stopped the concert. (*ibid.*)
c. Prince Charles is destroying the monarchy (with his undignified behavior). (*ibid.*)
d. The stock market crash destroyed Sam's life. (*ibid.*)

Our take on these examples is different; we are struck by the fact that they all contain thin causative verbs (*change, stop, destroy*). This leads us to our proposal, namely that the directness constraint bearing on thick and thin verbs is not exactly the same. Since thick causative verbs must abide by production, they must also abide by directness *qua* absence of intervening causer (cf. (76)). But since thin causatives do not have to abide by production, we expect them not to have to abide by directness in this particular sense. And indeed, verbs like *destroy, kill* or *change* raise no difficulties in context making clear that there is no exchange of quantities between the subject's referent and the object's referent. We illustrated this amply with the case of fact-denoting subjects, acceptable with thin causatives. This is rather unexpected if all causatives obey (76): since this definition seems to presuppose that the causer and the causee are linked through an *eventive* causal chain, it does not make clear predictions about omissions or facts. By contrast, a production analysis generates predictions about omissions and fact-denoting subjects, which are all borne out: thin causatives should accept them, while thick ones should not. This provides significant support for the production analysis.

The difference between thick and thin causative verbs can also be observed with subjects with concrete reference. We looked at event-denoting subjects in section 3, but the same pattern appears with individual-denoting subjects. Take for instance the contrast between (78b), which contains the thick causative verb *crack*, and (79b), which contains the thin causative verb *damage*:

(78) John's car tire is flat and so when driving, weight is no longer evenly distributed across the axel. As a result, the axel cracked.
a. The flat tire caused the axel to crack.
b. The flat tire cracked the axel.

(79) John's car tire is flat and so when driving, weight is no longer evenly distributed across the axel. As a result, the axel is damaged.
a. The flat tire caused the axel to be damaged.
b. The flat tire damaged the axel.

In (78)-(79), there is no transfer of quantities from the flat tire to the axel. Rather, the driving is the transference cause, and the flat tire is just a necessary condition for this transference cause to happen. And while (78b) (with a thick causative) is much less acceptable than (78a), the contrast between (79b) (with a thin causative) and (79a) is much weaker. This shows that thick causative verbs require direct causation under Wolff's (2003) definition – which the production constraint is the positive version of – while thin causative verbs do not.

The two additional contrasts below illustrate the same point. In each case, the subject's referent is a necessary condition for the exchange of physical quantities from a distinct and implicit entity to the object's referent (the driving in (80), the texting in (81)).

(80) *Crash* (thick) vs. *destroy* (thin). Andy is driving through the mountains and recent storms have damaged the road, making it extremely uneven. As a result, the car crashed/is destroyed.

a. The uneven road caused the car to crash.
b. #The uneven road crashed the car.
c. The uneven road caused the car to be destroyed.
d. The uneven road destroyed the car.

(81) *heat up* (thick) vs. *ruin* (thin). Suzy bought a new phone that has a manufacturing defect: when texting it heats up. After buying the phone, she texts her friend. As a result, it heated up/it is ruined.

a. The manufacturing defect caused the phone to heat up.
b. #The manufacturing defect heated up the phone.
c. The manufacturing defect caused the phone to be ruined.
d. The manufacturing defect ruined the phone.

It is probably not accidental that many cases raised in the literature in favor of the directness constraint involve thick causative verbs. For instance, Fodor (1970) uses *melt* to make his point that lexical causatives can only express causation between temporally contiguous causes and effects.[24] Also, more than half of causative verbs used in Wolff's (2003) Experiment 3 are thick (*break, pop, melt, burn, wave, crack*). Furthermore, authors arguing against the directness constraint as defined in (76) often illustrate their point on the basis of examples built with thin causative verbs, most notably *kill*; cf. Neeleman & Van de Koot (2012), Martin (2018); see also the examples (77) that Wolff (2003) discusses as potential counter-examples to his directness constraint.

Some other cases discussed as counter-examples to the directness constraint do contain thick causative verbs, but they are then often taken in their figurative or non-literal meaning, see e.g. (82) (see also (77)). But as we have seen, when a thick causative verb is taken in a figurative or abstract meaning, it does not have to abide by production, which is why Wolffian directness is then not in force either.

(82) a. Anglican Church say overpopulation may break eighth commandment.
(Neeleman & Van de Koot 2012: 28)
b. A large fleet of fast-charging cars will melt the grid. (*ibid.*)

Turning back to thin lexical causatives, it may be that they are still specialized in the expression of direct causation via the competition with overt causative forms, but under another, and weaker,

24 "The point is, roughly, that one can cause an event by doing something at a time which is distinct from the time of the event. But if you melt something, then you melt it when it melts." (Fodor 1970: 433)

definition of directness, such as unmarked (i.e. intentional) causative situations (McCawley 1978, Wolff 2003) or causal sufficiency (Martin 2018, Baglini & Bar-Asher Siegal 2025). This might explain why in some of our examples with abstract reference, the lexical causative may still be preferred to *cause*, even if the contrast is much weaker than in the case of thick causatives. In any case, it it important to pay attention to the distinction between thick and thin causatives when testing and assessing the directness constraint.

7 Conclusion

A long-standing view in lexical semantics is that all lexical causative verbs (e.g., *kill, burn*) are "thin", specifying only a result state while remaining silent about the manner of causation. But this view confronts a puzzle: verbs like *burn* or *melt* behave very differently from verbs like *kill* or *destroy*, particularly in the selectional restrictions they impose on an inanimate subject. If lexical causatives are uniformly thin, then why do these lexical causatives behave differently? Because the class of lexical causatives is fundamentally bifurcated:

> **Thin causative verbs** (e.g., *kill*, *destroy*, *damage*, *activate*): These conform to the traditional analysis, specifying a result without constraining the manner of causing.
>
> **Thick causative verbs** (e.g., *burn*, *break*, *bury*, *flood*): These verbs convey information about the way the result is brought about (either via an event property, like *burn*, or via a state property, like *bury*).

The primary argument for this distinction rests on what we have termed the "production-based causation constraint". Expanding on Rose et al. (2021), we demonstrated that thick causative verbs, when used in their physical sense, are systematically incompatible with subjects that denote non-productive, "dependence-based" causes (D-CAUSE). This "allergy" extends beyond mere absences (#*The lack of sunscreen burned the skin*) to include a wide range of abstract subjects, such as verbal gerunds (#*Andy's leaving the phone on the table burned it*) and quality-denoting DPs built with dimensional nouns (#*The intensity of the sun's rays burned the skin*). We showed that thin verbs, in contrast, more readily accept such subjects, indicating they are not bound by the production constraint.

Our investigation into the nature of this "thickness" yielded two key conclusions. First, a corpus survey revealed a strong correlation between thick causatives and " causative manner verbs" (our name for Embick's 2009 *break*-causatives), which are identifiable by their ability to combine with adjectival strong resultatives (e.g., *break open*, *burn clean*). Second, this correlation is not a perfect identity. Verbs like *bury* are thick (they reject abstract subjects) but are not causative manner verbs (they reject strong resultatives). We conclude that a verb can be "thick" by specifying manner in one of two ways: either by lexicalizing an event property (like *burn*) or by lexicalizing a state property whose nature entails a specific production process (like *buried*).

To account for why the production constraint exists but is defeasible – disappearing in figurative senses (*His lack of egotism melted me*) and in anticausative frames (*The vase broke from a lack of proper packing*) – we proposed a pragmatic explanation. The constraint is not a semantic clash but a result of the pragmatic competition between the covert (lexical) and overt (periphrastic *cause*

to...) forms. Where P-CAUSE is a salient option (i.e., in the physical sense), the more specific lexical form (e.g., *burn*) specializes in expressing this more specific P-CAUSE meaning, leaving the general cause form to cover the weaker D-CAUSE concept. This also bears on the "directness constraint" in that the production constraint is the deeper explanation for directness (as "no intervening causer"), and explains why the directness constraint so defined only holds for thick causative verbs.

The systematic bifurcation of the causative lexicon into "thick" and "thin" classes provides clear linguistic evidence for a cognitive distinction between a stronger production meaning for causation (P-CAUSE), which asymetrically entails a weaker dependence meaning (D-CAUSE). This distinction is the predictable consequence of pragmatic competition, where the "thickness" of a verb's root – whether it specifies a manner of acting or a state entailing a specific production process – determines its specialization.

The method adopted for our research is novel in that, rather than choosing ourselves the verbs that test the hypotheses – as is usually the case in lexical semantics – we created a list based on theory-independent systematic criteria. The price to pay is that we had to apply the thick/thin distinction to non-paradigmatic verbs, but the results are more robust.

One of the hypotheses that this method allowed us to disprove is that thick causatives alternate while thin ones do not. In fact, alternating verbs appear in both classes. It is striking, however, that while 50% of thin verbs in our working list alternate (12/24), 76% of thick verbs do so (10/13). Our data therefore suggest that thickness promotes the causative/anticausative alternation and thus influences argument structure. More generally, it confirms that idiosyncratic root content is relevant to grammatical structures, in line with Hovav & Levin's (2008) 'verb sensitivity hypothesis' (see also Spalek & McNally 2025).

Given our proposal that the specialization of thick causatives in the expression of P-CAUSE results from competition with overt causatives that can also convey D-CAUSE with the same number/type of arguments, one prediction is that the allergy to facts of thick causatives will be less pronounced in a language that does not have overt periphrastic causatives of this type. Although this needs to be verified experimentally, French seems to confirm this prediction. Indeed, even though in French, as in English, thick causatives do not combine very well with abstract subjects (see (69) and (83b)), the incompatibility seems to be more attenuated than in English. This is expected given the inventory of overt causative forms in French. French does not have a direct equivalent to English *cause*, since French *causer* only combines with a nominal (rather than infinitival) complement, see (83a). Furthermore, the French overt causative *faire*+infinitive construal does not seem to be able to convey D-CAUSE like English *cause* does; rather, *faire*+inf. seems to preferably convey P-CAUSE, like English *make* does (Rose et al. 2025).[25] For instance, (83c) does not sound much better than (83b), which is intuitively due to the fact that the subject of *faire*+inf. is represented as an effector in the core use of this construal.[26]

25 The preference of *make* for P-CAUSE observed by Rose et al. (2025) fits well with Nadathur & Lauer's (2020) proposal that *make* expresses causal sufficiency, under the assumption that productive causes generally are sufficient causes.

26 This is probably related to the fact that the *faire à*+inf. (Kayne 1977) we construction have in (83c) is associated with an 'obligation effect' (Folli & Harley 2007): the matrix subject *forces* the Causee to be involved in the embedded event. Another factor that makes (83c) an imperfect candidate is that the embedding of a verbal structure with a dative of inalienable possession under *faire* triggers the rather complex configuration of clitics that we see in (83c).

(83) a. *Le manque de protection solaire a causé/ provoqué/ entraîné des brûlures.*
the lack of sun protection has caused caused triggered some burns
'The lack of sun protection caused burns.'

b. ?*Le manque de protection lui a brûlé les mains.*
the lack of protection DAT has burned the hands
'The lack of protection burned her hands.'

c. ?*Le manque de protection lui a fait se brûler les mains.*
the lack of protection DAT has made REFL burn the hand
'The lack of protection made me burn my hands.'

d. *Le manque de protection a fait que je me suis brûlé les mains.*
the lack of protection has made that I REFL am burned the hands
'The lack of protection caused me to burn my hands/my hands to be burned.'

The *faire que* 'make that' construal is closer to English *cause* in that it specialises in expressing D-CAUSE, cf. (83d) (see also Raffy 2025 on the difference between the causal relations conveyed by *faire*+inf. and *faire que*).[27] But this latter structure has a very different syntax and semantics than the corresponding lexical causative: it denotes a relation between individuals and propositions, and the complement supplies the proposition (Grano 2024, Raffy 2025). This means that it does not compete with the lexical causative the same way as *cause* in English. Consequently, French speakers must choose between a rock and a hard place if they aim to convey a transitive relation via a change-of-state verb between a fact-denoting subject and an individual-denoting object. As this semantic work does not fit perfectly into any structure, lexical causatives might end up having to do the job, what would explain our impression that the allergy to abstract subjects is less strong in French than in English. More generally, it would be interesting to test the pragmatic account of the distributional restrictions on the subject of thick causatives in languages with different inventories of overt and covert causative verbs.

8 Appendix: Corpus data in English

Our queries were as follows (using the verb *burn* as an example):

27 Like English *cause* (cf. footnote 72), *faire que* has properties of achievement verbs such as the incompatibility with agent-oriented adverbials, while *faire*+inf. is aspectually closer to the lexical causative counterpart (e.g. it is compatible with agent-oriented adverbials, see (84b)). Also, *faire que* does not progressivize as easily as *faire*+inf, see (84c/d):

(84) a. Amid a fait patiemment/attentivement/prudemment fondre le chocolat.
'Amid patiently/carefully/cautiously made the chocolate melt.'

b. Amid a (#patiemment/#attentivement/#prudemment) fait que le chocolat a fondu.
'Amid patiently/carefully/cautiously cause the chocolate to melt.'

c. Amid est en train de faire fondre le chocolat.
'Amid is making the chocolate melt.'

d. #Amid est en train de faire que le chocolat fond.
'Amid is causing the chocolate to melt.'

```
Q1 [lemma = "the"][]{0,1}
   [lemma = "intensity|quality|level|height|temperature|
   property"][lemma = "of"][tag = "DT"][tag = "N.*"]
   [lemma = "burn" \& tag = "V.*"]

Q2 [lemma = "lack|absence|shortage|inexistence|existence"]
   [lemma = "of"]{0,1}[][tag = "N.*"]
   [lemma = "burn" & tag = "V.*"]

Q3 [tag = "PP.?|N.*"][lemma = "burn" & tag = "V.*"]
   [tag = "D.*"][tag = "N.*"][tag = "J.*"]
```

Q1 and Q2 are the queries for lexical causative statements with a subject denoting either a degree, an omission or a fact. Q3 is the query for resultative constructions.

8.1 Omission or quality subjects with thin causative verbs in English

(85) *affect*

a. How does **the lack of oxygen affect the brain**?[ex27]
b. **The quality of the oil affects the cool operation** of the motor.[ex28]

(86) *activate*

a. Even short-term **lack of sleep activates the amygdala**.[ex29]
b. Our findings demonstrate that **a lack of cryptochrome activates these proinflammatory molecules**.[ex30]
c. When the motor vehicle body passes through the paint bake oven, **the temperature of the oven activates blowing agents** in the expandable plastic that is constrained between the two sheet metal layers, causing it to expand and squeeze out between the two layers of metal.[ex31]

(87) *change*

a. It does not get much light so I am wondering is this really a prickly pear and is **the lack of sunlight changing it**?[ex32]
b. i was sitting in wonder at how much **the absence of sugar changed my body and my mood**.[ex33]
c. **The rough-hewn quality of the jute changed the brushstrokes** of both the painters.[ex34]
d. **The quality of the meat changed each plate**.[ex35]

(88) *close*: only abstract events

a. my grief has steadily intensified as **lack of snow closed the mountain** where I learned to ski.[ex36]
b. The **lack of anesthetics closed the operating rooms** at KKUK.[ex37]

(89) *cool*

a. **the lack of sun cools the ground**.[ex38]
b. Closer to home, "normal" weather is also affected by the eclipse. First, **the lack of sunlight cools the Earth**. [ex39]

(90) *dry*

a. As the scorching and unusual temperatures and **lack of rain dry the surrounding landscape**, unprecedented numbers of fires have followed.[ex40]
b. **Lack of water dries the mouth**.[ex41]
c. We had some fruit when we left in June, so I think **lack of watering dried the poor thing up**.[ex42]
d. **The lack of water dried up** much of the plant material.[ex43]

(91) *eliminate*

a. The speakers are easy to mount almost anywhere you like as long as they remain within range of the receiver. **The lack of wire eliminates the clutter** and hassle of attaching the wires to the wall or hiding them from view as speakers are installed in various places.[ex44]
b. **The absence of nickel eliminates allergic reactions to the skin**.[ex45]
c. **The absence of heat eliminates burns** and increases safety among plant workers.[ex46]
d. The character of structure is guaranteed and **the quality of the glass eliminates noise** and improves insulation.[ex47]

(92) *enhance*

a. **lack of eelgrass enhances resuspension of sediments**.[ex48]
b. the **lack of leptin enhances insulin action** in the beta cells and promotes insulin secretion, which was the result we expected.[ex49]
c. **a lack of sleep enhances hunger signals** in the brain and increases levels of hormones which affect our appetite [ex50]
d. we found that **the absence of Cdk5 enhances cell proliferation**.[ex51]

(93) *extend*

a. On the second dive we omitted the 50 ft survey due to too much surge at that depth and **lack of walls extending that shallow.** [ex52]
b. However, it's readable in most lighting conditions, and the **lack of a backlight extends battery life**.[ex53]
c. The **lack of a surgeon extended the 21-day service interruption** in the Pontiac Community Hospital's (PCH) obstetrics (OBS).[ex54]

(94) *hurt*

a. **lack of sunlight hurts crops**.[ex55]
b. Even with his eyes squeezed shut, **the intensity of the glare hurt his head**.[ex56]

(95) *kill*: see examples in section 2.

(96) *lower*: no relevant hits
This verb is mostly used with a quality noun in object position (*Lack of nutrition lowers the body's resistance*). The change-of-location meaning (*He lowered the flag*) was not found with fact-denoting subjects.
Constructed examples:

a. **The sudden lack of air pressure lowered the balloon**. (thin causative)
b. #**The sudden lack of air pressure dropped the balloon**. (thick causative)

(97) *open*

a. Trails becoming muddier, but **the lack of leaves opens vistas** that are usually obscured in the Summer.[ex57]
b. Cracking snow quality extends off the piste, and **the height of the area opens up some unmissable views** (you can see the Dolomites from Schwarze Schneide on a clear day).[ex58]

(98) *put*

a. A high risk, high reward quirk, the user must be careful when using this ability, as **the intensity of the laser puts stress** on the heart. [ex59]
b. **Lack of nutrients puts stress on cells and organisms**, and this has been the case since the emergence of life.[ex60]
c. And, while Atlas's naked form is consistent with Hellenistic sculpture, tradition may be only one facet of his nakedness. In addition, **the lack of clothing puts man and heaven** in direct contact.[ex61]

d. **Lack of water puts stress on plants**.[ex62]
e. **the intensity of the light puts great pressure on the physical vehicle**, and this can be interpreted as "stress" and "depression".[ex63]
f. The **low height of the stool put Sara's eyes just about at Chloe's chin level**.[ex64]

(99) *restore*
Additionally, **the absence of Ifnar1 restored microglial activation**, indicating a tonic IFN signal which needs to be negatively controlled [...].[ex65]

(100) *set* (with *off*)

a. The **lack of fire set off a chain of events** where small trees and dead wood, that used to be cleaned up by the frequent fires, began to accumulate.[ex66]
b. For some people, **a lack of sleep sets off their headaches**.[ex67]

(102) *slow*

a. **the higher temperatures and lack of moisture slowed the color change**.[ex68]
b. **The lack of oxygen slowed the reactions** that produce the amino acid proline[ex69]
c. **Lack of sleep slows the release of growth hormone**.[ex70]
d. **the high temperature of that coffee slows down the intake**, and after two or three cups, most know to stop.[ex71]

(103) *start/stop*

a. **Absence of dystrophin starts a chain reaction** that eventually leads to muscle cell degeneration and death.[ex72]
b. My life was saved, but my left hand was a bleeding stump. **The intensity of the cold stopped the flow of blood.**[ex73]
c. and if they come into it when a land-wind blows, which might seem to favour their getting out again, **the height of the mountain stops the wind**[ex74]
d. **Lack of moisture stops the conversion** of nitrates to protein.[ex75]
e. The heat popped the emergency brake line, and then **the lack of slope stopped the car**, along with the now liquid rubber tires.[ex76]
f. **The lack of electricity stops the flow of water** and it ceases the necessary current for medical machinery such as incubators, dialysis machines, and oxygen.[ex77]

(104) *trigger*

a. Eventually, **this lack of carbohydrates triggers a metabolic stat**e called ketosis, which causes your body to burn fat for energy instead of storing it.[ex78]
b. Melatonin is a hormone secreted by the pineal gland as a controller of circadian rhythm (**the absence of light triggers this production**).[ex79]
c. **Lack of sleep triggers a hormone** in the blood which stimulates the appetite.[ex80]
d. **the level of the waste triggers the pump to kick on**.[ex81]

(105) *turn*

a. **the lack of rain turned the grass into a crunchy brown**[ex82]
b. Five-and-a-half miles up, **lack of oxygen turns the brain to Playdoh** and every step sends the breath racing.[ex83]
c. **Lack of refrigeration turned the milk.**[ex84]
d. **the absence of sunlight turned the grapes bitter**[ex85]
e. **Lack of sleep turns this stress hormone on** and into over drive[ex86]

8.2 Omission or quality subjects with thick causative verbs in English

(106) *break, bury, cut, drop, mix, shut, spread, strech, switch*: no relevant examples

(107) *burn/lift/lock/melt*: see examples in section 3

8.3 Strong resultatives with thin causative verbs

(108) *trigger*

a. Your presence **triggers the door open** and you can try again when the bees return to the hive.[ex87]
b. The main trigger **triggers the door open or closed** [...][ex88]

(109) *turn*: see *turn something blue*, etc

(110) *set*: see *set the animals free*, etc

No examples for the 22 other thin causative verbs in the working list.

8.4 Strong resultatives with thick causative verbs

(111) *break* (see also Ausensi et al. 2024)
As she did not respond to the knocking on the door, the hospital staff **broke it open** and found her lying dead.[ex89]

(112) *burn* (see also Ausensi et al. 2024)

a. It was getting dark out and the twilight sun **burned the sky red** to the west.[ex90]
b. Once you're dead, the Warrior will **burn this planet clean**!
c. There shall come a time, I think, when humanity sees itself reflected, and **burns the darkness clean**.
d. He learned how the women of the country washed laundry before they had electricity: pulling water from wells, building fires to boil water, washing with lye, which **burned their hands raw**, lifting the heavy wet laundry with a stick.

(113) *bury*: no examples

(114) *cut*

a. you can **cut the holes open** using either a buttonhole cutter.[ex91]
b. Now Johnson hopes to **cut Britain loose from the E.U**.[ex92]

(115) *drop*

a. I **dropped my phone dead** in a pan of grease last night.[ex93]
b. HHH **drops a chair flat** on the ground and drops Rollins on top of it with a Pedigree.[ex94]

(116) *lift*

a. it was easy to lose a hand as the cable **lifted the plane clear** of the water.[ex95]
b. More footage of the vessel's hydraulic lift system **lifting the platform free** of the platform's legs[ex96]
c. Nate **lifted the window open**, only for the owl to swoop in and land on his dresser[ex97]
d. Leylin **lifted the entrance open** with confusion written all over his face[ex98]

(117) *lock*

a. Jimmi just pounds on the bass and Fred **locks the groove solid** so the band came together quickly.[ex99]
b. the attendant **locked the gate open** for her.[ex100]
c. these very strong attractive and repulsive forces, being completely in balance, in effect **lock the atoms motionless** in position and produce the rigidity and inflexibility which characterises most solid elements.[ex101]
d. the top of Trail Ridge Road in Rocky Mountain National Park is soon to close for the season as winter **locks the roads impassable**.[ex102]

(118) *melt*

I had some luck **melting the edges smooth** with an old soldering iron, but the results were shoddy at best.[ex103]

(119) *mix*

a. Tom **mixed the beverage full** and fa'r, And slammed it, smoking, on the bar.[ex104]
b. In 3 steps, explain how you **mix the color green** using paint. – In less than 5 steps, tell me how to make a collage[ex105]
c. It seems to really irritate people if they can't hear the words. We **mixed the voice hotter** on this one.[ex106]

(120) *shut*[28]

a. It is programmable for cycles though out the day and throughout the year, with a vacation zone to **shut it lower** while we are not at home.[ex107]
b. My mobber threw my backpack out on the pre-roof. When I climbed out to reclaim it, he **shut the window sealed**.[ex108]

(120) *spread*

a. Janine **spread the butter thick** on her bread. [ex109]
b. Dar **spread the magazine open** and gazed at the advertisement [...][ex110]
c. Kuu **spread the map flat** against the side of the nearest building.[ex111]

28 In favor of the idea that *shut* differs from *close* in that it is more compatible with strong resultatives, see also the contrast between *He shut/??closed the door off its hinges*.

(121) *stretch*

a. An ellipse can be constructed by tying a string to two pins and drawing like this with the pencil **stretching the string taut**.[ex112]
b. turning The Hobbit book into three films **stretches these characters thin** in terms of personality[ex113]
c. The weight of the blankets **stretched the sheet flat** and leaden above him. [ex114]
d. Alonzo, for such was his name, sprang forward, and with one blow of his fist **stretched the creature dead** upon the road.[ex115]

(122) *switch*

a. Treading carefully, she made her way to the TV and manually **switched it open**.[ex116]
b. So, it won't show it to as many people if you do **switch it public** part way through the stream.[ex117]

References

Alexiadou, Artemis, Elena Anagnostopoulou & Florian Schäfer. 2015. *External arguments in transitivity alternations: A layering approach*. Oxford: Oxford University Press.

Alexiadou, Artemis, Fabienne Martin & Florian Schäfer. 2017. Optionally causative manner verbs. Paper presented at the conference *Roots V*, London. amor.cms.hu-berlin.de/~schaeffl/papers/roots-final.pdf.

Alexiadou, Artemis & Florian Schäfer. 2006. Instrument subjects are agents or causers. In Donald Baumer, David Montero & Michael Scanlon (eds.), *Proceedings of the 25th west coast conference on formal linguistics (wccfl 25)*, 40–48. Somerville, MA: Cascadilla Proceedings Project.

Alonso-Ovalle, Luis & Henrison Hsieh. 2021. Causes and expectations: On the interpretation of the Tagalog ability/involuntary action form. *Journal of Semantics* 38(3). 441–472.

Anagnostopoulou, Elena. 2017. Voice, manners, and results in adjectival passives. In Roberta D'Alessandro, Irene Franco & Angel J. Gallego (eds.), *The verbal domain*, 105–128. Oxford: Oxford University Press.

Asher, Nicholas. 1993. *Reference to abstract objects in discourse*, vol. 50 Studies in linguistics and philosophy. Dordrecht; Boston: Kluwer Academic.

Asher, Nicholas & Alex Lascarides. 2003. *The logics of conversation*. Cambridge: Cambridge University Press.

Ausensi, Josep & Alessandro Bigolin. 2021. Resultatives and low depictives in English. *The Linguistic Review* 38(4). 573–604.

Ausensi, Josep, Ryan Walter Smith & Jianrong Yu. 2023. The roots of strong and weak resultatives in English and Spanish. Handout for a talk presented at the 32nd Colloquium on Generative Grammar (CGG 32).

Ausensi, Josep, Ryan Walter Smith & Jianrong Yu. 2024. On the expression of resultativity in English: The view from multiple resultatives. *Glossa-A Journal of General Linguistics* 9(1). 1–32.

Baglini, Rebekah & Elitzur A Bar-Asher Siegal. 2025. Modeling linguistic causation. *Linguistics and Philosophy* 48(4). 647–691.

Bartsch, Renate & Theo Vennemann. 1972. The grammar of relative adjectives and comparison. In Thomas Storer & David Winter (eds.), *Formal aspects of cognitive processes*, 168–185. Berlin: Springer.

Beavers, John, Michael Everdell, Kyle Jerro, Henri Kauhanen, Andrew Koontz-Garboden, Elise LeBovidge & Stephen Nichols. 2017. Two types of states: A cross-linguistic study of change-of-state verb roots. *Proceedings of the Linguistic Society of America* 2(38). 1–15.

Beavers, John, Michael Everdell, Kyle Jerro, Henri Kauhanen, Andrew Koontz-Garboden, Elise LeBovidge & Stephen Nichols. 2021. States and changes of state: A crosslinguistic study of the roots of verbal meaning. *Language* 97(3). 439–484.

Beavers, John & Andrew Koontz-Garboden. 2017. Change of state verbs and the semantics of roots. In *Proceedings of the 34th West Coast Conference on Formal Linguistics (WCCFL 34)*, 347–354.

Beavers, John & Andrew Koontz-Garboden. 2020. *The roots of verbal meaning*. Oxford: Oxford University PRess.

Beavers, John & Andrew Koontz-Garboden. 2012. Manner and result in the roots of verbal meaning. *Linguistic Inquiry* 43(3). 331–369. https://doi.org/10.1162/LING_a_00093.

Benz, Anton. 2006. Partial blocking and associative learning. *Linguistics and Philosophy* 29. 587–615.

Bigolin, Alessandro & Josep Ausensi. 2021. A new resultative construction in Spanish? A reply to Rodríguez Arrizabalaga. *Folia Linguistica* 1–30.

Bittner, Maria. 1998. Concealed causatives. *Natural Language Semantics* 7. 1–78.

Blutner, Reinhard & Torgrim Solstad. 2001. Two case studies in lexical pragmatics. In Enikö Németh & Károly Bibok (eds.), *Pragmatics and the flexibility of word meaning*, vol. 8 Current Research in the Semantics / Pragmatics Interface, 11–28. Leiden / Boston: Brill. https://doi.org/10.1163/9780585474267_005.

Bott, Oliver & Torgrim Solstad. 2014. From verbs to discourse: A novel account of implicit causality. In Barbara Hemforth, Barbara Mertins & Cathrine Fabricius-Hansen (eds.), *Psycholinguistic approaches to meaning and understanding across languages*, 213–251. Dordrecht: Springer.

Bouchard, Denis. 1995. *The Semantics of Syntax*. Chicago [u.a.]: Chicago University Press.

Brennenstuhl, W. & K. Wachowicz. 1976. On the pragmatics of control. In *Proceedings of the 2nd Annual Meeting of the Berkeley Linguistics Society*, 396–397. Berkeley, CA: Berkeley Linguistics Society.

Brousseau, Anne-Marie & Elizabeth Ritter. 1991. A non-unified analysis of agentive verbs. In Dawne Bates (ed.), *Proceedings of the 10th West Coast Conference on Formal Linguistics (WCCFL 10)*, 53–64. Somerville, MA: Cascadilla Proceedings Project.

Cao, Angela, Aaron White & Daniel Lassiter. 2025. Cause, make, and force as graded causatives. *Experiments in Linguistic Meaning* 3. 88–103.

Cartwright, Nancy. 1979. Causal laws and effective strategies. *Noûs* 419–437.
Copley, Bridget. 2019. Force dynamics. In Robert Truswell (ed.), *The Oxford handbook of event structure*, 103–149. Oxford University Press.
Copley, Bridget & Heidi Harley. 2015. A force-theoretic framework for event structure. *Linguistics and Philosophy* 38(2). 103–158. https://doi.org/10.1007/s10988-015-9168-x.
Copley, Bridget & Phillip Wolff. 2014. Theories of causation should inform linguistic theory and vice versa. In Bridget Copley & Fabienne Martin (eds.), *Causation in grammatical structures*, 11–57. Oxford: Oxford University Press.
Copley, Bridget, Phillip Wolff & Jason Shepard. 2015. Force interaction in the expression of causation. In Sarah D'Antonio, Mary Moroney & Carol Rose Little (eds.), *Proceedings of SALT 25: 25th Semantics and Linguistic Theory Conference*, 433–451.
Croft, William. 1991. *Syntactic categories and grammatical relations: The cognitive organization of information*. Chicago, IL: University of Chicago Press.
Cruse, D. A. 1972. A note on English causatives. *Linguistic Inquiry* 3. 522–528.
Davis, Henry & Hamida Demirdache. 2000. On lexical verb meanings: Evidence from Salish. In Carol Tenny & James Pustejovsky (eds.), *Events as grammatical objects*, 97–142. Stanford, CA: CSLI Publications.
DeLancey, S. 1983. Agentivity and causation: Data from Newari. In *Proceedings of the 9th Annual Meeting of the Berkeley Linguistics Society*, 54–63. Berkeley, CA: Berkeley Linguistics Society.
DeLancey, Scott. 1991. Event construal and case role assignment. In *Proceedings of the 17th annual meeting of the berkeley linguistics society*, 338–353.
Doron, Edit. 2003. Agency and voice: The semantics of the semitic templates. *Natural Language Semantics* 11(1). 1–67.
Dowe, Phil. 2000. *Physical causation*. Cambridge: Cambridge University Press.
Dowty, David R. 1979. *Word meaning and Montague grammar*. Dordrecht: D. Reidel.
Elliott, Patrick D. 2020. *Elements of clausal embedding*: UCL (University College London) dissertation.
Embick, David. 2004. On the structure of resultative participles in English. *Linguistic Inquiry* 35(3). 355–392.
Embick, David. 2009. Roots, states, and stative passives. Paper presented at the *Roots workshop*, University of Stuttgart. www.ling.upenn.edu/~embick/stut.pdf.
Fábregas, Antonio & Raquel González Rodríguez. 2020. On inhibited eventualities. *Natural Language & Linguistic Theory* 38. 729–773.
Ágnes Farkas, Imola. 2009. Some differences between English and Romanian resultative constructions. *Bucharest Working Papers in Linguistics* XI(2). 59–71.
Fauconnier, Stefanie. 2012. *Constructional effects of involuntary and inanimate agents: A cross-linguistic study*. Leuven: Katholieke Universiteit Leuven dissertation.
Fodor, Jerry. 1970. Three reasons for not deriving *kill* from *cause to die*. *Linguistic Inquiry* 1(4). 429–438.
Folli, Raffaela & Heidi Harley. 2005. Consuming Results in Italian and English: Flavours of v. In Paula Kempchinsky & Roumyana Slabakova (eds.), *Aspectual enquiries*, 95–120. Dordrecht: Springer.

Folli, Raffaella & Heidi Harley. 2007. Causation, obligation, and argument structure: On the nature of little v. *Linguistic Inquiry* 38(2). 197–238. https://doi.org/10.1162/ling.2007.38.2.197.

Folli, Raffaella & Heidi Harley. 2020. A head movement approach to Talmy's typology. *Linguistic Inquiry* 41(3). 425–470.

Gentner, Dedre. 1978. On relational meaning: The acquisition of verb meaning. *Child Development* 49. 988–998.

Gergely, G. & T. G. Bever. 1986. Related intuitions and the mental representation of causative verbs in adults and children. *Cognition* 23. 211–277.

Glass, Leila. 2021. English verbs can omit their objects when they describe routines. *English Language & Linguistics* 26(1). 49–73.

Godfrey-Smith, Peter. 2010. Causal pluralism. In Helen Beebee, Christopher Hitchcock & Peter Menzies (eds.), *Oxford handbook of causation*, 326–337. Oxford: Oxford University Press.

Grano, Thomas. 2024. Intention reports and eventuality abstraction in a theory of mood choice. *Linguistics and Philosophy* 47. 265–315.

Grice, Paul. 1989. *Studies in the way of words*. Cambridge, MA.: Harvard University Press.

Grimm, S. & L. McNally. 2015. The -ing dynasty: Rebuilding the semantics of nominalizations. In S. D'Antonio, M. Moroney & C. R. Little (eds.), *Proceedings of the 25th semantics and linguistic theory conference (salt)*, vol. 25, 82–102. Ithaca, NY: LSA and CLC Publications.

Hall, Ned. 2004. Two concepts of causation. In John Collins, Ned Hall & Laurie Paul (eds.), *Causation and counterfactuals*, 225–276. Cambridge, MA: MIT Press.

Halpern, Joseph Y. & Judea Pearl. 2005. Causes and explanations: A structural-model approach. part i: Causes. *The British Journal for the Philosophy of Science* 56(4). 843–887.

Higginbotham, James. 2000. On events in linguistic semantics. In James Higginbotham, Fabio Pianesi & Achille C. Varzi (eds.), *Speaking of events*, 49–79. New York: Oxford University Press.

Hitchcock, Christopher. 2001. The intransitivity of causation revealed in equations and graphs. *The Journal of Philosophy* 98. 273–299.

Hobbs, Jerry R. 2005. Toward a useful concept of causality for lexical semantics. *Journal of Semantics* 22(2). 181–209.

Hopperdietzel, Jens. 2024. Manner/result polysemy as contextual allosemy: Evidence from Daakaka. *Natural Language & Linguistic Theory* 1–58.

Hovav, Malka Rappaport & Beth Levin. 2008. The English dative alternation: The case for verb sensitivity. *Journal of linguistics* 44(1). 129–167.

Huang, Zi. 2023. *Verbal gerunds in English: a case study in natural language ontology and referentiality*. Barcelona: Universitat Pompeu Fabra dissertation.

Kallulli, Dalina. 2006. Argument demotion as feature suppression. In Benjamin Lyngfelt & Torgrim Solstad (eds.), *Demoting the agent*, 144–166. Amsterdam: Benjamin.

Kamp, Hans & Uwe Reyle. 1993. *From Discourse to Logic*. Dordrecht: Kluwer.

Kaufmann, Ingrid. 2002. Exploring the semantic expressivity of a 2-feature system. *Theoretical Linguistics* 28. 341–356.

Kayne, Richard. 1977. *Syntaxe du français: Le cycle transformationnel*. Paris: Seuil.

Kilgarriff, Adam, Vít Baisa, Jan Bušta, Miloš Jakubíček, Vojtěch Kovář, Jan Michelfeit, Pavel Rychlỳ & Vít Suchomel. 2014. The Sketch Engine: ten years on. *Lexicography* 1(1). 7–36.

Kim, Jiyoun, Hanjung Lee & Ye-eun Cho. 2025. Semantic and contextual constraints on the causative alternation in English: a multifactorial analysis. *Corpus Linguistics and Linguistic Theory* .

Kim, Youngjin. 2024. The subject of a stative object experiencer verb is an intensional cause. *Proceedings of the Linguistic Society of America* 9(1). 5688–5688.

Kiparsky, Paul. 1982. Lexical phonology and morphology. In I. Yang (ed.), *Linguistics in the morning calm*, Seoul: Hanshin.

Kiparsky, Paul. 1997. Remarks on denominal verbs. In Alex Alsina, Joan Bresnan & Peter Sells (eds.), *Complex predicates*, 473–499. Stanford: CSLI.

Kistler, Max. 2014. Analysing causation in light of intuitions, causal statements, and science. In Bridget Copley & Fabienne Martin (eds.), *Causation in grammatical structures*, vol. 52, 76–99. Oxford: Oxford University Press.

Koenig, Jean-Pierre & Anthony R. Davis. 2001. Sublexical modality and the structure of lexical semantic representations. *Linguistics & Philosophy* 24(1). 71–124.

Kratzer, Angelika. 2005. Building resultatives. In Claudia Maienborn & Angelika Wöllstein-Leisten (eds.), *Event arguments in syntax, semantics and discourse*, 178–212. Tübingen: Niemeyer.

Kratzer, Angelika. 2006. Decomposing attitude verbs. Talk given at the Hebrew University of Jerusalem.

Levin, Beth. 1993. *English verb classes and alternations*. Chicago & London: University of Chicago Press.

Levin, Beth. 2020. Resultatives and constraints on concealed causatives. In E. A. Bar-Asher Siegal & Nora Boneh (eds.), *Perspectives on causation* Jerusalem Studies in Philosophy and History of Science, 185–218. Springer. https://doi.org/10.1007/978-3-030-34308-8_8.

Levin, Beth & Malka Rappaport Hovav. 1991. Wiping the slate clean. *Cognition* 41. 123–151.

Levin, Beth & Malka Rappaport Hovav. 1995. *Unaccusativity : at the syntax-lexical semantics interface*. Cambridge, MA: MIT Press.

Levin, Beth & Malka Rappaport Hovav. 2005. *Argument realization*. Cambridge: Cambridge University Press.

Levin, Beth & Malka Rappaport Hovav. 2013. Lexicalized meaning and manner/result complementarity. In Boban Arsenijevic, Berit Gehrke & Rafael Marín (eds.), *Studies in the composition and decomposition of event predicates*, 49–70. Berlin: Springer.

Lewis, David. 1973. Causation. *The Journal of Philosophy* 70. 556–567.

Löbner, Sebastian. 2020. The Partee paradox. Rising temperatures and numbers. In Daniel Gutzmann, Lisa Matthewson, Cécile Meier, Hotze Rullmann & Thomas Ede Zimmermann (eds.), *The Wiley companion to semantics*, Hoboken, NJ: Wiley.

Lombrozo, Tania. 2010. Causal–explanatory pluralism: How intentions, functions, and mechanisms influence causal ascriptions. *Cognitive psychology* 61(4). 303–332.

Lyon, A. 1967. Causality. *The British Journal for the Philosophy of Science* 18. 1–20.

Martin, Fabienne. 2018. Time in probabilistic causation: Direct vs. indirect uses of lexical causative verbs. In Uli Sauerland & Stephanie Solt (eds.), *Proceedings of Sinn und Bedeutung 22*, vol.

60-61, 107–124. ZAS Papers in Linguistics.
Martin, Fabienne, Florian Schäfer & Christopher Piñón. 2025. Transitives with inchoative semantics. *Glossa* 10(1). 1–43.
Mateu, Jaume. 2012. Conflation and incorporation processes in resultative constructions. In Violeta Demonte & Louise McNally (eds.), *Telicity, change and state*, 252–278. Oxford: Oxford University Press.
McCawley, James D. 1978. Conversational implicature and the lexicon. In *Pragmatics*, 245–259. Brill.
McHugh, Dean. 2023. *Causation and modality: Models and meanings*. University of Amsterdam.
McMillion, Alan. 2006. *Labile verbs in english: Their meaning, behavior and structure*. Stockholm: Stockholm University, Faculty of Humanities, Department of English Doctoral dissertation.
McNally, Louise & Alexandra Spalek. 2022. Grammatically relevant aspects of meaning and verbal polysemy. *Linguistics* 60(6). 1943–1987. https://doi.org/10.1515/ling-2020-0167.
Merin, Arthur. 1999. Information, Relevance, and Social Decisionmaking: Some Principles and Results of Decision-Theoretic Semantics. In Larry Moss, J. Ginzburg & Marteen de Rijke (eds.), *Logic, language and computation*, vol. 2, Stanford, CA: CSLI Publications.
Moltmann, Friederike. 2013. *Abstract objects and the semantics of natural language*. Oxford: Oxford University Press.
Nadathur, Prerna. 2023. Causal semantics for implicative verbs. *Journal of Semantics* 40(2-3). 311–358.
Nadathur, Prerna & Sven Lauer. 2020. Causal necessity, causal sufficiency, and the implications of causative verbs. *Glossa: a journal of general linguistics* 5(1). https://doi.org/doi.org/10.5334/gjgl.497.
Nash, Léa & Rajesh Bhatt. in press. Two routes to indirect causation. *RGG – Rivista di Grammatica Generativa* .
Neeleman, Ad & Hans Van de Koot. 2012. The linguistic expression of causation. In Martin Everaert, Marijana Marelj & Tal Siloni (eds.), *The Theta system: Argument structure at the interface*, 20–51. Oxford: Oxford University Press.
Parsons, Terence. 1990. *Events in the semantics of English*. Cambridge, MA: MIT Press.
Partee, Barbara. 1979. *Subject and object in modern English*. New York: Garland.
Paul, A., L.̇2009. Counterfactual theories. In Helen Beebee, Christopher Hitchcock & Peter Menzies (eds.), *The Oxford handbook of causation*, 158–184. Oxford University Press.
Peterson, P. 1997. *Facts, propositions, events*. Kluwer Academic Press.
Piñón, Christopher. 1997. Achievements in an event semantics. In Aaron Lawson (ed.), *Semantics and linguistic theory (SALT) 7*, 273–296. Ithaca, NY: Cornell University. https://doi.org/10.3765/salt.v7i0.2781.
Piñón, Christopher. 2001. A finer look at the causative-inchoative alternation. In Rachel Hastings, Brendan Jackson & Zsofia Zvolenszky (eds.), *Proceedings of semantics and linguistic theory 11*, Ithaca, New-York: CLC Publications, Cornell University.
Pinker, Stephen. 1989. *Learnability and cognition*. Cambridge, MA: MIT Press.
Portner, Paul. 1992. *Situation theory and the semantics of propositional expressions*. Amherst, MA: University of Massachusetts at Amherst dissertation.

Pross, Tillmann. 2019. Dispositions and the verbal description of their manifestations: a case study on emission verbs. *Linguistics & Philosophy* 43. 149–191. https://doi.org/doi.org/10.1007/s10988-019-09268-5.

Raffy, Clémentine. 2025. Expressing complex causal relations: French *faire-que* constructions. Talk presented at COCOA.

Rapoport, Tova. 2014. Verb meaning and context. In G. Girard-Gillet (ed.), *Autour du verbe anglais*, 121–137. Paris: Presses Sorbonne Nouvelle.

Rappaport Hovav, M. & B. Levin. 1999. Two types of compositionally derived events. Unpublished manuscript, Bar Ilan University, Ramat Gan and Northwestern University, Evanston, IL.

Rappaport Hovav, Malka. 2014. Lexical content and context: The causative alternation in English revisited. *Lingua* 78. 8–29.

Rappaport Hovav, Malka. 2016. Grammatically relevant ontological categories underlie manner/result complementarity. In Noa Brandel (ed.), *Proceedings of IATL 2016*, 77–98. MIT Working Papers in Linguistics.

Rappaport Hovav, Malka & Beth Levin. 1998. Building verb meanings. In Miriam Butt & Wilhelm Geuder (eds.), *The projection of arguments: Lexical and compositional factors*, 97–134. Stanford, CA: CSLI Publications.

Rappaport Hovav, Malka & Beth Levin. 2010. Reflections on manner/result complementarity. In Edit Doron, Malka Rappaport Hovav & Ivy Sichel (eds.), *Syntax, lexical semantics, and event structure*, 21–38. Oxford University Press: Oxford.

Reichenbach, Hans. 1959. The principle of causality and the possibility of its empirical confirmation. In Hans Reichenbach (ed.), *Modern philosophy of science*, 109–134. London: Routledge & Kegan Paul.

Rett, Jessica. 2020. Manner implicatures and how to spot them. *International Review of Pragmatics* 12(1). 44–79.

Rose, David, Eric Sievers & Shaun Nichols. 2021. Cause and burn. *Cognition* 207.

Rose, David, Siying Zhang, Shaun Nichols, Ellen Markman & Tobias Gerstenberg. 2025. How children map causal verbs to different causes across development. *Nature Human Behaviour* .

Ryle, Gilbert. 1949. *The concept of mind*. Harmondsworth: Penguin/Peregrine Books.

Schäfer, Florian. 2008. *The syntax of (anti-)causatives. External arguments in change-of-state contexts*. Amsterdam & Philadelphia: Benjamins.

Schäfer, Florian. 2009. The causative alternation. *Language and Linguistics Compass* 3(2). 641–681.

Schäfer, Florian. 2012. Two types of external argument licensing–the case of causers. *Studia Linguistica* 66(2). 128–180.

Schlesinger, Izchak M. 1989. Instruments as agents. *Journal of Linguistics* 25. 189–210.

Schulz, Katrin. 2011. 'if you'd wiggled a, then b would've changed'. causality and counterfactual conditionals. *Synthese* 179. 239??251.

Schäfer, Florian. 2024. Anticausatives in transitive guise. *Natural Language & Linguistic Theory* 43(1). 421–475.

Shibatani, Masayoshi. 1976. The grammar of causative constructions: A conspectus. In Masayoshi Shibatani (ed.), *The grammar of causative constructions*, vol. 6 Syntax and Semantics, 1–42. New York: Academic Press.

Shibatani, Masayoshi. 2002. *The grammar of causation and interpersonal manipulation*. Amsterdam; Philadelphia, PA: Benjamins Pub. Co.

Smith, Carlota. 1970. Jespersen's 'move and change' class and causative verbs in English. In Ali Jazayery, Edgar Polomé & Werner Winter (eds.), *Linguistic and literary studies in honor of Archibald A. Hill*, 101–109. The Hague: Mouton de Gruyter.

Spalek, Alexandra Anna & Louise McNally. 2025. The anatomy of a verb: *Tear*, *rasgar*, and lexical equivalence. *Languages in Contrast* .

Stockwell, Robert P., Paul Schachter & Barbara H. Partee. 1973. *The major syntactic structures of English*. New York: Holt, Rinehart and Winston Inc.

Suppes, Patrick. 1973. A probabilistic theory of causality. *British Journal for the Philosophy of Science* 24(4).

de Swart, Henriëtte & Arie Molendijk. 1999. Negation and the temporal structure of narrative discourse. *Journal of Semantics* 16. 1–42.

Talmy, Leonard. 1991. Path to realization: A typology of event conflation. In *Annual meeting of the Berkeley linguistics society*, vol. 17 1, 480–519.

Talmy, Leonard. 2000. *Toward a cognitive semantics. volume I: Concept structuring systems*. Cambridge, MA: MIT Press.

Tobin, Yishai. 1993. *Aspect in the English verb: Process and result in language* Longman Linguistics Library. Addison-Wesley Longman.

Uegaki, Wataru. 2015. Content nouns and the semantics of question-embedding. *Journal of Semantics* 33(4). 623–660.

Van Rooy, Robert. 2004. Signalling games select horn strategies. *Linguistics and philosophy* 27. 493–527.

Vendler, Zeno. 1967. *Linguistics in philosophy*. Ithaca, NY: Cornell University Press.

Verhagen, A. & S. Kemmer. 1997. Interaction and causation: A cognitive approach to causative constructions in Modern Standard Dutch. *Journal of Pragmatics* 27. 61–82.

Washio, Ryuichi. 1997. Resultatives, compositionality and language variation. *Journal of East Asian Linguistics* 6. 1–49.

Wierzbicka, A. 1975. Why 'kill' does not mean 'cause to die': The semantics of action sentences. *Foundations of Language* 13. 491–528.

Williamson, Jon. 2009. Probabilistic theories. In Helen Beebee, Christopher Hitchcock & Peter Menzies (eds.), *The oxford handbook of causation*, Oxford, pages = 185–212,: Oxford University Press.

Wolff, Phillip. 2003. Direct causation in the linguistic coding and individuation of causal events. *Cognition* 88(1). 1–48.

Wolff, Phillip. 2007. Representing causation. *Journal of experimental psychology: General* 136(1). 82.

Wood, Jim & Alec Marantz. 2017. The interpretation of external arguments. In Roberta D'Alessandro, Irene Franco & Ángel Gallego (eds.), *The verbal domain*, 255–278. Oxford: Oxford University Press.

Yu, Jianrong, Josep Ausensi & Ryan Walter Smith. 2023. States and changes-of-state in the semantics of result roots: Evidence from resultative constructions. *Natural Language & Linguistic*

Theory 41. 1589–1628.
Zucchi, Alessandro. 1993. *The language of propositions and events: Issues in the syntax and the semantics of nominalization*. Berlin: Springer.

Sources of examples

[ex1] www.rogerebert.com/etheriel-musings/ten-films-four-days-relentless-hong-kong
[ex2] /www.vedantawritings.com/Ish21p4.pdf
[ex3] www.phoenixsong.net/fanfiction/story/622/
[ex4] www.ejnet.org/ej/ntcf.pdf
[ex5] www.bigsoccer.com/threads/cl-as-roma-fc-porto-august-23rd-2016-r.2034663/page-6
[ex6] https://newsroom.uw.edu/story/study-ids-potential-new-target-treat-viral-infections
[ex7] www.offnews.info/verArticulo.php?contenidoID=33283
[ex8] iagenweb.org/civilwar/books/logan/mil204p4.htm
[ex9] www.unfogged.com/archives/comments_15391.html
[ex10] hum-molgen.org/NewsGen/09-2006/000014.html
[ex11] indianf.com/smart-bandage-for-a-smart-recovery/
[ex12] helovia.com/showthread.php?tid=21343
[ex13] www.realclimate.org/index.php/archives/2006/01/can-2c-warming-be-avoided
[ex14] www.reddit.com/r/pregnant/comments/1e52fbb/what_made_you_absolutely_unhinged_today/
[ex15] orcz.com/Borderlands_2:_Handsome_Jack_Quotes
[ex16] www.core77.com/posts/69842
[ex17] seattletransitblog.com/2020/02/17/sound-transit-presents-initial-fare-enforcement-report/
[ex18] www.hhwlod.com/blogs/132-the-code-is-zeek/660-hobbit-desolation-of-smaug-movie-review
[ex19] www.jonimitchell.com/library/view.cfm?id=200
[ex20] x.com/caraquilts/status/1616495779564118016?s=12&t=aUD72sdzzdrD9rI8o6jTwQ
[ex21] ewfountains.com/fountain-support/
[ex22] inu.adult-fanfiction.org/story.php?no=600097136&chapter=20
[ex23] Sandin, P. (2003). Robot mechanisms and mechanical devices illustrated. McGraw Hill Professional.
[ex24] www.physlink.com/news/Index.cfm?ID=600
[ex25] www.alecomm.com/index.php/family-law-3/death-by-family-courts-2/2545-dad-burns-daughter-alive-in-bitter-custody-battle
[ex26] www.nirs.org/chernobyl-myths-misconceptions-it-couldnt-happen-here/
[ex27] www.pbs.org/wgbh/nova/everest/
[ex28] www.mtfca.com/books/1911Inst.htm
[ex29] www.bustle.com/p/these-9-little-sleep-mistakes-can-have-impact-on-your-mental-health-17132993
[ex30] www.brightsurf.com/news/article/080112299757/scientists-discover-molecular-link-between-circadian-clock-disturbances-and-inflammatory-diseases.html
[ex31] patents.justia.com/patent/4989913
[ex32] www.atpm.com/11.04/arizona/prickly-pear-cactus.shtml
[ex33] adriennemareebrown.net/2014/05/09/amb-and-sugar-sitting-in-a-tree-amb-get-out-of-my-tree/
[ex34] vineyardgazette.com/tags/art-shows?page=29
[ex35] www.johnharveyphoto.com/Austin/TheBigThreeBBQMeats.htm
[ex36] www.stuff.co.nz/environment/climate-news/300279032/therapists-are-reckoning-with-ecoanxiety
[ex37] telegrafi.com/en/the-lack-of-anesthetics-closed-the-operating-theaters-in-the-city/
[ex38] crystalspringcsa.com/2009/06/23/the-weather/
[ex39] https://www.discovermagazine.com/the-sciences/science-experiments-for-the-public-during-the-solar-eclipse
[ex40] iccinet.org/burning-the-high-arctic-2020-spring-and-summer-fire-season-in-sakha-republic-a-precursor-of-fire-seasons-to-come/
[ex41] www.accessinfohub.com/showarticle.php?article=29451
[ex42] fictionaut.com
[ex43] santafenm.gov/media/files/land_use/RIVER_CORRIDOR_PLAN_-_FINAL_12-14-17_small_file.pdf
[ex44] www.ezinepost.com/articles/article-271600.html
[ex45] www.thornandoak.com/zoppini-jewelry-italian-charms-and-bracelets-from-italy/
[ex46] www.giiresearch.com/report/moi391701-global-pressure-sensitive-adhesives-market.htm

[ex47] www.greenmatch.co.uk/double-glazing/secondary-glazing/secondary-glazing-cost
[ex48] www.wiser.eu/key-messages/transitional-and-coastal-water-management/
[ex49] /www.bio-medicine.org/biology-news-1/Joslin-researchers-uncover-potential-role-of-leptin-in-diabetes-629-1/
[ex50] blog.examone.com/blog/2013/01/29/13-ways-to-stay-on-track-in-2013/
[ex51] prism.ucalgary.ca/handle/11023/1286
[ex52] www.baue.org/projects/great_pinnacle/data/species.php
[ex53] in.pcmag.com/printers/144150/brother-p-touch-home-personal-label-maker-pt-d202
[ex54] www.pontiacjournal.com/news/service-interruptions-continue-new-surgeon-agreement-hoax
[ex55] www.aonprd.com/Rules.aspx
[ex56] www.baen.com/chapters/acc_10.htm
[ex57] visitnorthcreek.org/blog-and-news/
[ex58] www.sno.co.uk/ski-resort/best-ski-resorts-austria/
[ex59] mangahelpers.com/forum/threads/your-quirk.2999979/page-2
[ex60] www.fightaging.org/archives/2021/08/fight-aging-newsletter-august-30th-2021/
[ex61] www.electrummagazine.com/2016/09/the-farnese-atlas/
[ex62] www.gardeninginfozone.com/planting-tips-and-advice
[ex63] www.energeticforum.com/forum/energetic-forum-main/energetic-science-ministries/1398-channeled-writings-from-the-archangels-ascended-masters/page4?t=1331&s=b430f1ba645a6e6bdadb8ffa3c6544fb
[ex64] www.ausxip.com/fanfic21/tlf5.html
[ex65] pubmed.ncbi.nlm.nih.gov/25896511/
[ex66] www.usgs.gov/center-news/new-mexico-landscapes-field-station-research-informs-fire-management
[ex67] www.healthline.com/health/migraine/what-to-ask-doctor-migraine
[ex68] wdet.org/posts/2019/10/11/88723-fall-colors-start-to-emerge-across-michigan-with-the-best-views-up-north/
[ex69] www.asbmb.org/asbmb-today/people/030119/calculating-the-protein-evolution-connection
[ex70] www.inverse.com/mind-body/scientists-reveal-minimum-amount-of-activity-needed-to-combat-health-risks
[ex71] snack-girl.com/snack/monster/
[ex72] www.futurity.org/duchenne-muscular-dystrophy-dogs-1032682-2/
[ex73] /www.gutenberg.org/cache/epub/6808/pg6808-images.html
[ex74] www.readprint.com/chapter-12773/Arabian-Nights-Vol-1-Anonymous
[ex75] columbiaheartbeat.com/index.php/mizzou/280-071212
[ex76] www.smalldeadanimals.com/2021/07/16/we-dont-need-no-flaming-sparky-cars-66/
[ex77] www.usmlo.org/arch2006/2006-07/VR060710.HTM
[ex78] www.moms.com/turns-out-the-keto-diet-is-seriously-unhealthy/
[ex79] www.fiikus.net/?cfstreatment
[ex80] www.getnarked.net/forum/showthread.php?s=55e3edc992c940af71853d918f186122&t=2413
[ex81] www.rcap.org/to-flush-or-not-to-flush-grinder-pumps-in-low-pressure-systems/
[ex82] wtvbam.com/2018/06/05/unlike-last-year-rainy-spring-continues-in-the-area/
[ex83] old.bfi.org.uk/sightandsound/feature/137
[ex84] www.ahdictionary.com/word/search.html?q=turn
[ex85] www.barpublishing.com/the-years-without-summer.html
[ex86] www.get-fit-naturally.org/2012/01/has-your-progress-hit-a-wall/
[ex87] www.8bs.com/elecgame/exile_solution.htm
[ex88] community.smartthings.com/t/raspberry-pi-with-php-or-arduino-esp8266-nodemcu-to-gpio-to-relay-to-gate-garage-trigger/43335?page=6
[ex89] www.newindianexpress.com/states/tamil-nadu/2025/Nov/05/pregnant-woman-dies-by-suicide-at-private-hospital-in-tirunelveli
[ex90] www.lcfanfic.com/stories/1998/html/patching.html
[ex91] www.wikihow.com/Cut-Button-Holes#Using-a-Buttonhole-Cutter
[ex92] hnn.us/article/172692
[ex93] www.facebook.com/SHUGGiiE/posts/i-dropped-my-phone-dead-in-a-pan-of-grease-last-night-i-immediately-went-to-bed/10162363032524457/

[ex94] www.pwmania.com/wwe-payback-results-june-1-2014
[ex95] www.faem.com/rockwell/tttw-05.htm
[ex96] docsbay.net/title-one-mans-lift
[ex97] www.dotmoon.net/library_storyview.php?chapterid=3094
[ex98] www.buyvprx.com/Warlock-of-the-Magus-World-2073603.html
[ex99] guitar9.com/column/interview-td-clark-0
[ex100] www.shrug.info/Hogrider144/HOGRIDER%20144%20PART%201.html
[ex101] romunpress.co.nz/romunnose/a-critique-of-the-kinetic-theory-of-gases/
[ex102] www.weathernationtv.com/news/colorado-fall-winter/
[ex103] www.sparkfun.com/products/115
[ex104] www.daypoems.net/poems/1524.html
[ex105] theartofeducation.edu/2017/10/05/5-simple-pre-assessments-short-class-periods/
[ex106] /www.jonimitchell.com/library/view.cfm?id=200
[ex107] www.siliconinvestor.com/readmsg.aspx?msgid=33396940
[ex108] www.reddit.com/r/memes/comments/f3pjnu/it_do_be_like_that
[ex109] www.fawi.net/ezine/vol3no3/LGraves.html
[ex110] www.ausxip.com/fanfiction/mgood/target7.htm
[ex111] cff.ssw.net/forum/viewtopic.php?t=1432
[ex112] www.vias.org/physics/bk1_12_02.html
[ex113] www.hhwlod.com/blogs/132-the-code-is-zeek/660-hobbit-desolation-of-smaug-movie-review
[ex114] www.waxjism.org/cimorene/hp/thing.html
[ex115] etc.usf.edu/lit2go/139/the-brown-fairy-book/4342/the-story-of-the-yara/
[ex116] happydeathday.fandom.com/wiki/Tree_Gelbman_(first_dimension)
[ex117] www.johnaldred.com/youtube-gaming-channel-experiment/