CAUSAL MODIFICATION OF ADJECTIVAL PREDICATES: INSIGHTS FROM A CORPUS STUDY ON GERMAN CAUSAL *VON* ('FROM')

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1 Introduction

Predicative modifiers show a striking flexibility with respect to their combinatorics and interpretation. This poses a challenge for any semantic account that strives for parsimony of both the lexicon and the grammar. A particular case in point is German causal *von*-modifiers ('from') in combination with adjectival copula sentences. They support an eventive as well as a stative causal reading and, furthermore, they appear to tolerate certain coercive adaptions of their causal relata. See the data in (1)–(4):

(1)	Paul war müde von der Reise. Paul was tired from the trip		eventive reading
(2)	Paul war müde von den Tabletten. Paul was tired from the pills		
(3)	Der Himmel war schwarz von Vögeln. The sky was black from birds		stative reading
(4)	Der Platz war rot von den Blättern. The square was red from the leaves		ambiguous

In the sentences in (1) and (2), the *von*-phrase expresses an eventive causal relation between a trip, cf. (1), or some event related to the pills, cf. (2), and a result state of Paul being tired. In the case of (2), some adaptive measures are required to infer a suitable event. More specifically, (2) involves a coercion of the internal NP that yields a contextually plausible causing event such as the release of the pills' ingredients after taking them.

The stative reading of causal *von* is illustrated in (3). Here, a property of the sky, namely its blackness, is due to the blackness of the birds, which are furthermore supposed to be holistically located all over (relevant parts of) the sky. In (3) the causal relation does not hold among events but is of some stative nature. A sentence such as (4) is ambiguous. Besides its (predominant) stative reading, according to which the square's redness is due to the redness of the leaves (which must be spread over the square), it also has an eventive reading, according to which the leaves stained the square red and may have been removed in the meantime.

The two readings differ in two crucial respects. First, only stative *von* supports the inference that the main predicate also holds (*cum grano salis*) for the internal NP referent, cf. (5). That is, from the sentence in (5a) we may infer that the leaves are red, but from the sentence in (5b) we cannot draw the inference that the trip is tired.

(5) a. Der Platz ist rot von den Blättern. → The leaves are red.
The square is red from the leaves

b. Das Kind ist müde von der Reise. ↛ The trip is tired.
The child is tired from the trip

Secondly, only stative *von* implies that the internal NP referent is located on the subject referent at the time of the predication, cf. (6). Thus, from sentence (6a) (in its stative reading) we may infer that if it is true that the square is red from the leaves for some time span t, then it also holds that the leaves are located on the square during t. No such inference is valid for sentence (6b). All that matters for (6b) is that the bench is dirty due to the shoes. Whether the shoes are still located on the bench or not is irrelevant for the truth of the sentence.

(6) a. Der Platz ist rot von den Blättern. → The leaves are on the square.
The square is red from the leaves

b. Die Bank ist dreckig von den Schuhen. ↛ The shoes are on the bench.
The bench is dirty from the shoes

The two inference patterns illustrated in (5) and (6) may serve as diagnostics for differentiating eventive and stative readings of causal *von*. At first glance, the two readings seem to differ quite fundamentally, and one might wonder whether they have a common source at all. The aim of the present paper is to show that the two interpretations of causal *von* can in fact be traced back to a single lexical source which only varies in terms of the sortal type of the involved arguments. Based on a corpus study on causal *von*-modifiers in adjectival copula sentences, we investigate the semantic and ontological conditions that determine the interpretation of causal *von*.

The paper is organized as follows. Section 2 presents the results of our corpus study. This provides us with an empirically grounded overview of the core semantic and syntactic characteristics of causal *von*'s eventive and stative readings. Section 3 is devoted to identifying the common meaning that both readings share and their core difference. We will argue that eventive and stative causal *von* express non-agentive, direct causation in the sense of Wolff (2003). And they differ along the lines of Shibatani's (1973) distinction between ballistic and continuous causation. In section 4 we propose accounting for these insights in terms of a causal relation that may hold either between events or between tropes (i.e., concrete property manifestations; see Moltmann (2007, 2009, 2013)). This allows us to formulate the specific

requirements on direct causation in terms of spatiotemporal contiguity conditions for events and tropes. Section 5 provides a short summary and outlook.

Before turning to the corpus study, let us add a remark on German causal *von* as compared to English *from*. Although the meanings of the two prepositions overlap considerably, they do not match exactly. This is demonstrated by the sentences in (7)–(11):

(7) a. Paul ist müde von der Reise.
b. Paul is tired from the trip.

(8) a. Sein Gesicht war schwarz von dem Staub.
b. His face was black from the dust.

(9) a. Sein Hemd war schwarz von/*mit Dreck.
b. His shirt was black from/with dirt.

(10) a. Sein Gesicht war schwarz von/*mit einer Explosion.
b. His face was black from/*with an explosion.

(11) a. Dieses Bild wurde von Paul gemalt.
b. This picture was painted by Paul.

Both *von* and *from* may express eventive causation, cf. (7), and stative causation, cf. (8). Yet, whereas stative causal relations are expressed uniformly with *von* in German, English uses both *from* and *with*, cf. (9).[1] In the eventive case, English patterns again with German in only allowing *from*/*von*; cf. (10). Note that German *von* is also used for the expression of agents as in (11a). These distributional differences should be kept in mind throughout the paper.

2 Corpus Study

The corpus study was conducted in two German corpora, the Deutsches Referenzkorpus (DeReKo) and a dependency-parsed version of the web corpus SdeWaC.[2] In order to search the data, we used the tools COSMAS II and Sketch Engine. Overall, the study yielded 358 adjectival copula sentences with causal *von*-modifiers. These were annotated with respect to various categories: *von*'s causal reading, the sortal category and referential properties of the PP's internal argument, semantic properties of the adjectival predicate, and a couple of syntactic properties such as the linear ordering of the PP and the adjectival predicate and their (non-)adjacency.

Stative vs. eventive readings: In order to decide upon the reading of the *von*-phrase, we used the two diagnostics that we presented in the introduction; see (5) and (6). On this basis, 249 sentences were classified as eventive and 109 as stative. Examples are given in (12):[3]

[1] See Rapoport (2014) for an analysis of the *with*-cases.
[2] At the time the study was conducted, the DeReKo archive TAGGED-C contained about 1.5 billion morpho-syntactically annotated tokens. SdeWaC is part of the German web corpus deWaC and contains about 840 million tokens. For more information, see Baroni et al. (2009) on deWaC and Faaß & Eckart (2013) on SdeWaC.
[3] The number in square brackets at the end of a sentence indicates that the sentence is one of the 358 corpus examples.

(12) a. Seine Stimme war vom Anfeuern ganz heiser. [260] eventive reading
His voice was from.the cheer.INF totally hoarse

b. Ihre Finger waren rot von Blut. [62] stative reading
Her fingers were red from blood

Sortal category of *von*'s internal argument: The following categories were used to annotate the internal arguments of *von*: events, (physical) objects, abstract objects, temporal objects and tropes.[4] Examples are given in (13) for the eventive case and in (14) for the stative case.

(13) a. Jetzt sind die Finger noch klamm vom Laufen im Wind.[237] event
Now are the fingers still clammy from.the walk.INF in.the wind

b. … ich war noch satt von der Pizza. [265] object
I was still full from the pizza

c. "Wir waren perplex von der Härte des Polizeieinsatzes", … [29] trope
We were puzzled from the severity of.the police-action

d. Der Raum war halb dunkel und feucht von vergangenen Waschtagen.[174] temp. object
The room was half dark and damp from past wash-days

e. Ich bin krank (…) von dieser lauen Mitte. [211] abstr. object
I am sick from this half-hearted middle

(14) a. Seine Kleider waren stets weiß vom Mehlstaub … [339] object
His clothes were always white from.the flour-dust

b. Ihre schwarze Jacke ist nass von Tränen. [102] object
Her black jacket is wet from tears

c. Die Luft ist schwer von Blütenduft. [358] trope
The air is heavy from blossom-scent

Figure 1 depicts the distribution of the sortal categories with respect to the two readings.

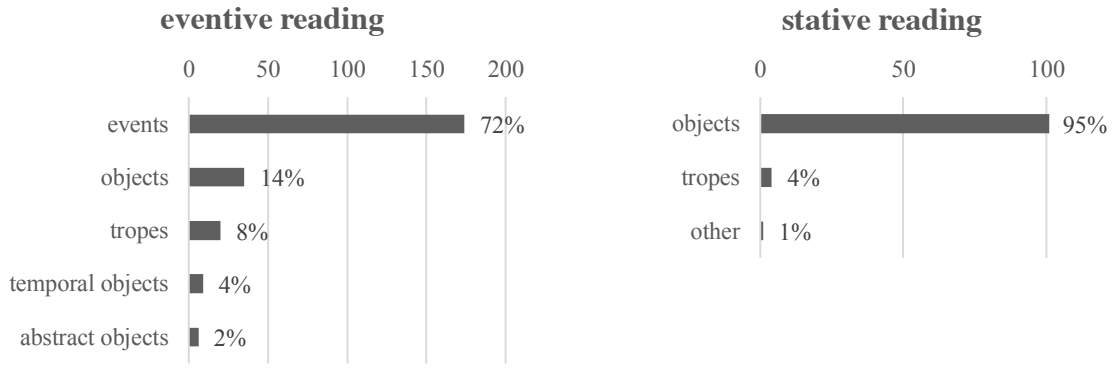

Figure 1: Sortal category of the internal NP-argument of *von*

[4] Tropes are "concrete manifestations of a property in an individual" (Moltmann 2009: 51). We will turn to a more thorough discussion of tropes and their characteristic features in section 4.

Figure 1 shows that the two readings clearly differ with respect to the sortal type of *von*'s internal argument. Whereas eventive causal *von* typically requires an internal argument of type event, stative causal *von* predominantly combines with concrete objects. Note that an eventive/stative ambiguity of causal *von* may only arise if the internal argument is of type object; cf. the sentence in (4).

Referential properties of *von*'s internal argument: As figure 1 shows, object referring expressions are the major category that we find with both readings. This raises the question of whether the particular causal reading – eventive or stative – can be derived from their specific referential properties. To clarify this issue, we further annotated *von*'s internal arguments of type object with respect to the following categories: singular count nouns, mass nouns, plural nouns with determiner (+det), and plural nouns without determiner (-det), i.e., bare plurals. Figures 2 and 3 display the respective distributions for the eventive and the stative case.

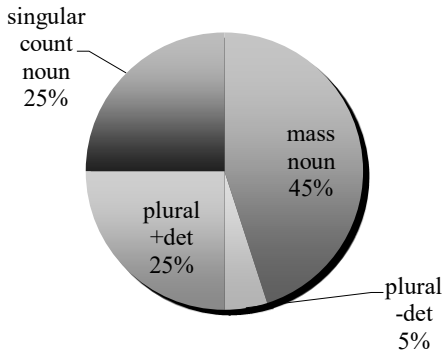

Figure 2: Internal NPs of type object (eventive reading)

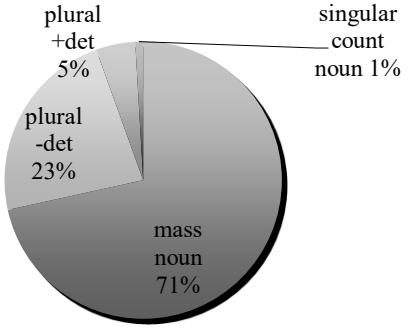

Figure 3: Internal NPs of type object (stative reading)

The two figures reveal notable differences. First, in the case of the eventive reading 25% of the object-denoting NPs referred to a singular count noun. On the stative reading, in contrast, there was only one such case of a singular NP, which – however – referred indirectly to a plurality, namely *Bücherpaket* 'packet of books'. More generally speaking, the stative causal reading requires internal arguments that denote masses or pluralities, i.e., they can be classified as homogeneous predicates in Krifka's (1989) terms. The eventive reading, in contrast, allows both homogeneous and quantized predicates.

One further assumption that comes to mind is that the two readings correlate with the distinction of strong vs. weak referentiality; cf. Milsark (1977). Take as an illustration the minimal pair in (15). The strong internal NP in (15a) leads most probably to an eventive reading, i.e., the reader infers a washing event that caused the shirt to become white. The weak internal NP in (15b), on the other hand, triggers a stative causal interpretation, according to which the whiteness of the shirt is caused by some washing powder that is located on the shirt.

(15) a Das Hemd ist weiß von dem Waschpulver.
The shirt is white from the washing-powder

b. Das Hemd ist weiß von Waschpulver.
The shirt is white from washing-powder

As suggestive as this minimal pair might appear at first glance, the corpus data in (16)–(17) show that there is no strict correlation between the NP's referentiality and the causal reading.

(16) a. ... die Schnitzereien an der Tischkante waren grau von Staub.[123]
... the carvings at the table-edge were grey from dust

b. Der Schnee ist grau von dem Staub.[110]
The snow is grey from the dust

(17) a. ... es [das Kind] war müde vom Wege, müde von Schlägen, und matt
... it [the child] was tired from.the road tired from blows and dull
vom Hunger … [195]
from.the hunger

b. Die Sitzbänke seien dreckig von den Schuhen. [17]
The benches were dirty from the shoes

In (16), the same noun *Staub* ('dust') builds the head of a weak (16a) and a strong (16b) NP, and in both cases *von* expresses a stative causal relationship. And in (17) *von* receives an eventive causal reading, irrespective of whether its internal argument is weak (17a) or strong (17b).[5] From these observations we conclude that there might be a strong preference for building stative causal readings on the basis of a weak NP and eventive readings based on a strong NP, but there is no strict correlation.[6] Thus, causal *von*'s eventive/stative ambiguity cannot be reduced to the strong/weak distinction of its internal argument but has its source in the lexical semantics of the preposition. We must leave the further exploration of the observed bias of causal *von*'s readings towards strong or weak internal NPs for future research.

Semantic category of the adjectival predicate: For the semantic annotation of the adjectival predicates we adopted the classification of the German WordNet version GermaNet, which is based on Hundsnurscher & Splett (1982).[7] The most frequent adjectives are listed in figures 4 and 5.[8]

[5] The conflated form *vom* 'from.the' yields a weak-referential interpretation of the internal NP; cf. Schwarz (2009).

[6] Note that – given an appropriate context – the readings of the minimal pair in (15) may well be reversed. For instance, a suitable context for a stative reading for (15a) is spelled out in (i). And a context for an eventive reading for (15b) is provided in (ii).

(i) Look what Max and Moritz did! Max spilled washing powder over the dark shirt and Moritz poured fabric softener on the floor.

(ii) Our lab studies the effectiveness of different detergents. We tested two dirty samples. The shirt was cleaned with washing powder and the blouse with liquid detergent.

[7] For more information on GermaNet, see, e.g., Hamp & Feldweg (1997), Henrich & Hinrichs (2010) and the GermaNet website: http://www.sfs.uni-tuebingen.de/GermaNet/.

[8] The list for the eventive reading in figure 4 contains only adjectives that occurred at least two times, whereas the list for the stative reading in figure 5 contains all adjectives that occurred in our corpus.

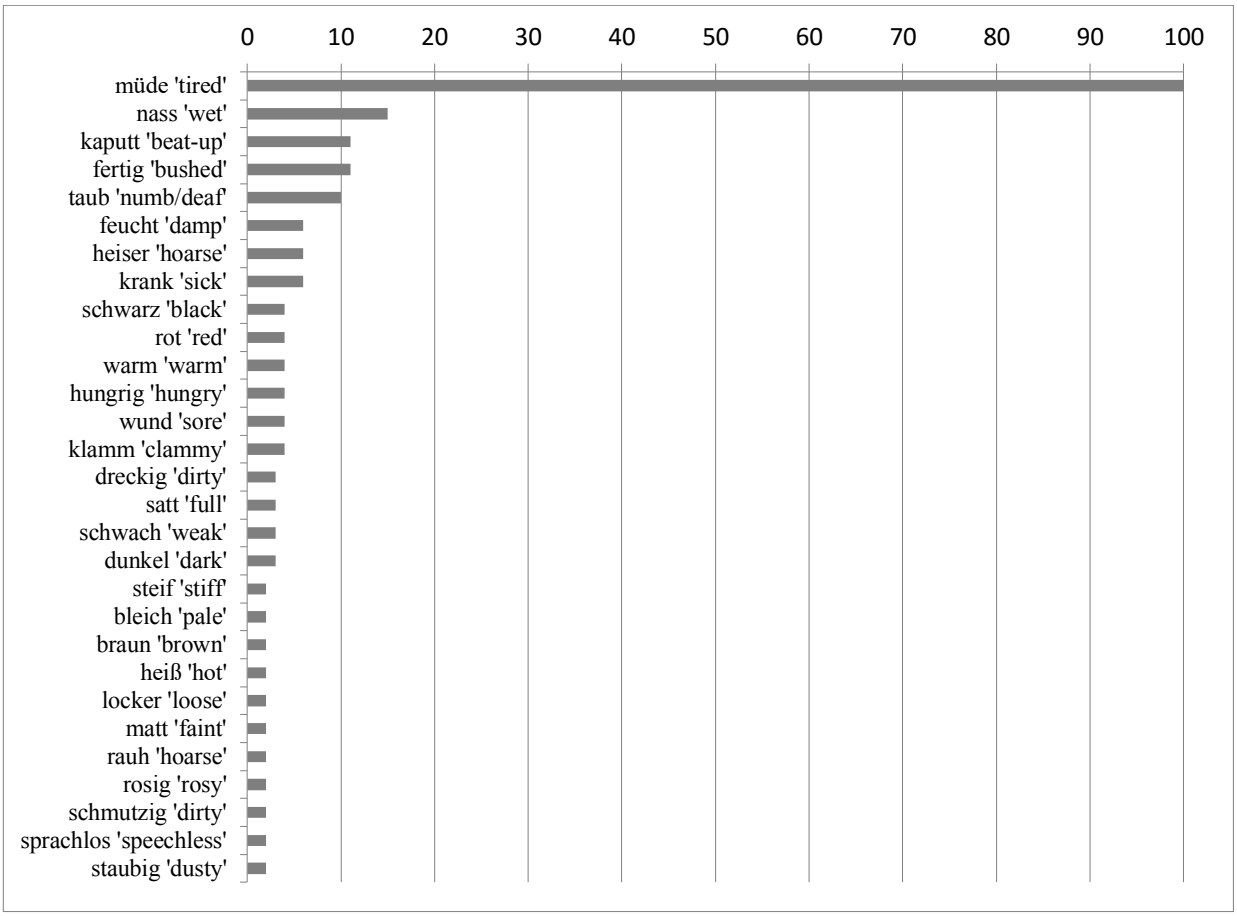

Figure 4: Adjectival predicates (eventive causal reading)

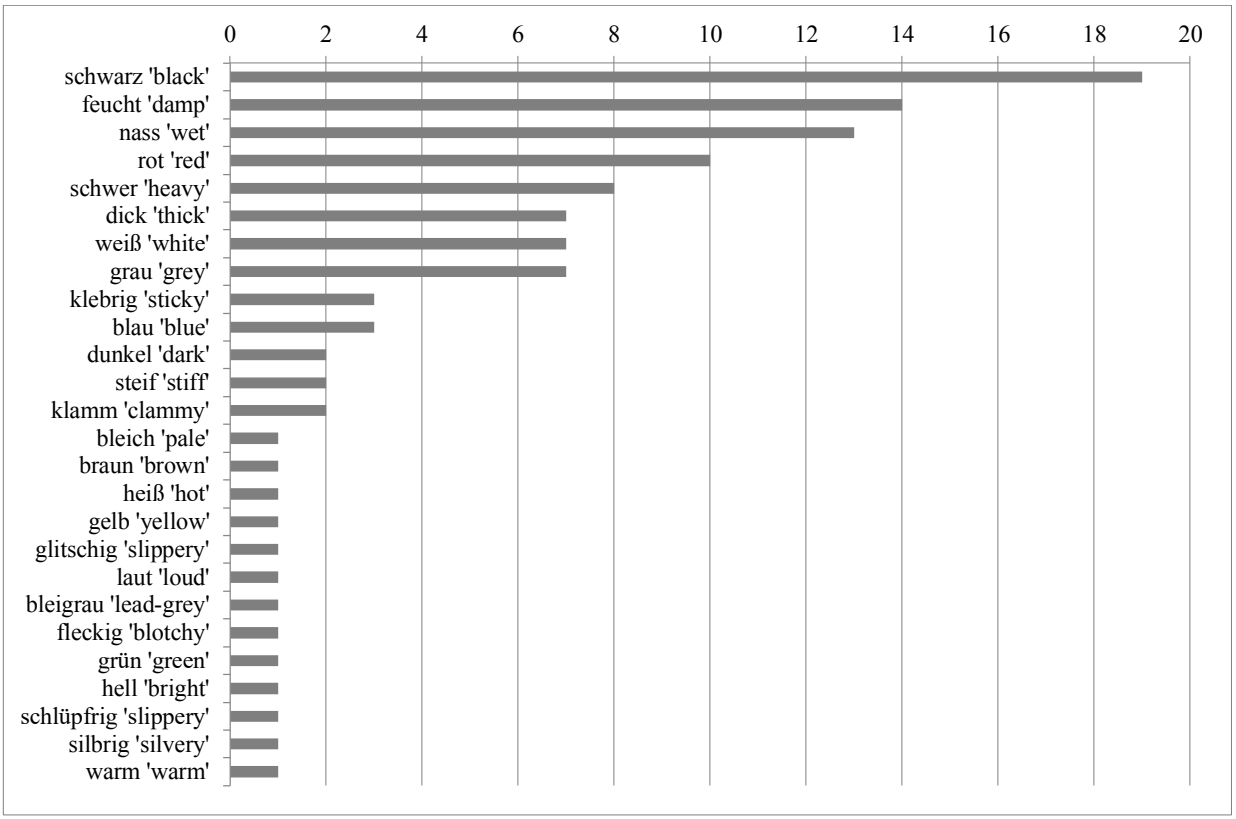

Figure 5: Adjectival predicates (stative causal reading)

The adjectival predicates can be assigned to the following semantic classes:

(18) Eventive reading:
- 70% body-specific, e.g., *müde* ‘tired’, *krank* ‘sick’, *heiser* ‘hoarse’
- 17% substance-specific, e.g., *staubig* ‘dusty’, *schmutzig* ‘dirty’, *nass* ‘wet’
- 8% perception-specific, e.g., *grau*‘ grey’, *rot* ‘red’, *dunkel* ‘dark’
- 5% other, e.g., *übermütig* ‘jaunty’, *sprachlos* ‘speechless’

(19) Stative reading:
- 50% perception-specific (see above)
- 47% substance-specific (see above)
- 3 % body-specific (bleich ‘pale’, steif ‘stiff’)

These data show that causal *von*’s eventive reading is compatible with a broader range of adjectival properties, but body-related properties predominate. Stative readings only emerge in combination with adjectives that denote rather basic, optically or haptically perceivable properties. Thus, primary sensory perceptibility of the caused effect appears to be a precondition for the stative reading of causal *von*-modifiers.

Syntactic distribution: The corpus data were annotated with respect to two syntactic criteria: (i) (non-)adjacency of AP and PP, and (ii) syntactic order of adjective and PP (for the adjacent cases). The results are given in (20) and (21):

(20) Eventive reading:
(i) 88% adjacent, 12% non-adjacent
(ii) 75 % Adj > PP, 25% PP > Adj

(21) Stative reading:
(i) 97 % adjacent, 3% non-adjacent
(ii) 94 % Adj > PP, 6% PP > Adj

The corpus data show that the order Adj > PP is strongly preferred in both readings. In fact, this appears to be the only legitimate order for the stative case. Eventive causal *von*-PPs are a bit more flexible: 25% of the eventive cases show the reverse order. A similar pattern emerges with respect to adjacency: in 12% of the eventive causal sentences the adjective and the *von*-phrase are non-adjacent, but the same holds for only 3% of the stative readings. Non-adjacent examples are given in (22) for the eventive reading and in (23) for the stative reading:

(22) a. Seine Stimme war vom Anfeuern ganz heiser. [260]
His voice was from.the cheer.INF totally hoarse

b. Zu tief war der Boden von den ausgiebigen Regenfällen der Nacht. [133]
Too deep was the ground from the extensive rain-falls of.the night

c. Und was, wenn die emsige Honigbiene müde ist vom
And what if the diligent honeybee tired is from.the
Blütenpollensammeln? [74]
blossom-pollen-collect.inf

(23) a. Doch seine Hände waren vom Schweiß ganz glitschig … [308]
But his hands were from.the sweat totally slippery

b. So dick sind ihre Beine vom Wasser. [94]
So thick are her legs from.the water

Let us first have a closer look at the deviations from the predominant order Adj > PP in the case of the eventive reading. In 86% of the deviations, both adjective and PP remain in the middle field, e.g., (22a). Furthermore, there were two instances of AP-topicalization, e.g., (22b). In nine cases the PP was extraposed to the right, e.g., (22c).

For the stative case, we encountered six sentences where the adjective followed the PP in the middle field, e.g., (23a), and one instance of AP-topicalization, cf. (23b). Moreover, it is striking to note that for stative *von* deviation from the order Adj > PP is always accompanied by additional focus particles or degree modifiers such as *ganz* ('totally') in (23a), which give the adjective more information-structural weight. This contrasts with the eventive case, where the order PP > Adj is overall more frequent and less dependent on additional linguistic support.[9] In

[9] Nearly half of the eventive causal *von*-sentences with the order PP > Adj lack additional degree modifiers, focus particles, etc. Note that while the eventive case (22a) remains perfectly fine if we drop *ganz* ('totally'), the stative case (23a) sounds less natural:

(i) Seine Stimme war vom Anfeuern heiser.
His voice was from.the cheer.INF hoarse
(ii) ? Seine Hände waren vom Schweiß glitschig.

sum, stative causal *von*-modifiers require particular information-structural support, e.g., strong emphasis on the adjectival predicate, in order to deviate from the order Adj > PP.

The above syntactic observations suggest that Adj > PP is the unmarked order for both readings. We take this as evidence that Adj > PP is in fact the base order; see Frey & Pittner (1998) and Frey (2003) on the base order of arguments and modifiers in the German middle field. Given that German is verb final (e.g., Haider 2010), this implies that the causal *von*-modifier must be part of the AP. Otherwise the copula could not first combine with its AP complement. Thus, we may conclude that the *von*-modifier is an adjectival modifier that adjoins to the AP. In the stative case, the PP appears to be rather reluctant to leave its AP-internal base position, whereas in the eventive case the PP is a bit more mobile. Our corpus data provide initial evidence that this difference between the two readings of causal *von*-modifiers could be related to different AP-internal base adjunction sites. A further exploration of these syntactic conditions on causal *von*-modifiers and their exploitation for a compositional semantic derivation of the two readings will have to await future research.

3 Eventive and Stative Causal *von*

The corpus study presented in the previous section provides a solid empirical basis for a semantic analysis of causal *von*. The analysis of the data has substantiated our claim that *von* has two clearly distinct causal readings that differ with respect to a series of semantic and distributional properties. For our further exploration of the semantics of causal *von*, let us first have a look at what both readings have in common.

First, both readings express an immediate causal relationship, along the lines of Wolff's (2003) notion of "direct causation." Wolff (2003:4f) defines direct causation as opposed to indirect causation as being present between the initial causer and the final causee "(1) 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."[10] In short, direct causation means that the causal chain is not interrupted by other causal factors. Both eventive and stative causal *von* show precisely this kind of direct causation. This is demonstrated by the sentences in (24) and (25).

(24) a. Paul ist müde von der Reise.
Paul is tired from the trip

b. Paul ist müde wegen der Reise.
Paul is tired because-of the trip

(25) a. Der Boden ist rot von dem Blut.
His hands were from.the sweat slippery

[10] The second condition ensures that the use of an instrument by an agent does not count as an intervening cause, whereas a second volitional agent would act as an intervening cause. Wolff (2003: 5) illustrates the second case with the following example: "if a father were to sit his preschool child up in a chair, the causation would count as direct since there is no intermediary between the father and the child, let alone one that could be construed as an intervening cause. In contrast, if a father were to tell his child to sit up, the causation would be indirect since the causee, the child, would also be acting as a causer, hence acting as an intervening cause."The granularity condition is discussed in more detail in Wolff (2003: 6).

The floor is red from the blood

b. Der Boden ist rot wegen des Bluts.
The floor is red because-of the blood

In (24a), Paul must have been a participant in a past trip, which led immediately to his tiredness. (24b), on the contrary, where *von* is replaced by the causal preposition *wegen* ('because of'), does not require Paul to be a participant in the trip. For instance, he could be tired because of organizing a trip for his parents. Moreover, (24b) has no constraints concerning the temporal contiguity between Paul's tiredness and the trip. The trip may take place at any time – be it in the past (Paul might be tired because of nightmares about a trip that took place long ago) or in the future. (25) illustrates the same kind of immediacy for *von*'s stative reading. The *von*-sentence (25a) requires spatial and temporal contiguity between the blood being on the floor and the floor being red. The blood must be located on the floor at the time of the predication. The *wegen*-sentence (25b), by contrast, also tolerates an indirect causal relationship, where no spatiotemporal contiguity between cause and effect holds. For instance, (25b) could refer to a situation where an eccentric landlord, being a fan of vampires and blood, tiled the floor of his house blood-red. Thus, unlike the more liberal causal preposition *wegen*, causal *von* is restricted to expressing a narrow notion of direct causation between a cause and its effect.[11] As the discussion of (24) and (25) has shown, both readings of causal *von* impose particular conditions on spatiotemporal contiguity between the cause and its effect. These conditions will be spelled out in the next section.

A second feature shared by the eventive and the stative reading of causal *von* relates to agentivity. Both readings express non-agentive causation. The cause is neither in control of the event (i.e., an agent) nor under external control (i.e., an instrument); cf., e.g., DeLancey (1984). Again, causal *von* differs from its fellow *wegen* in this respect; see the illustrations in (26)–(27).[12]

(26) a. *Maria ist müde / traurig von Peter.
Maria is tired / sad from Peter

b. Maria ist müde / traurig wegen Peter.
Maria is tired / sad because-of Peter

(27) a. *Maria ist müde von dem kaputten Spaten.
Maria is tired from the broken spade

b. Maria ist müde wegen des kaputten Spatens.
Maria is tired because-of the broken spade.

In (26a), *von*'s internal argument cannot be interpreted as an agent: *von* is blocked in a situation in which some action of Peter (be it intentional or unintentional) was the cause for Maria's tiredness or sadness. Yet *wegen* fits well in this case; see (26b). Furthermore, as (27)

[11] For a semantics of *wegen* ('because of') in terms of a causal relation between abstract entities such as propositions and facts, see Solstad (2010).

[12] Copley & Wolff (2014) make a similar observation for English *from* vs. *because of*. They note that whereas causal *from* is restricted to inanimate, non-volitional causers (Copley & Wolff 2014: 37), *because of* "is apparently not sensitive to how far away in the causal chain an agent is, or if there are any intermediate agents or causers in the chain" (Copley & Wolff 2014: 55).

shows, the same holds true for instruments. For a situation in which Maria got tired because of digging up the garden with a broken spade, only *wegen* can be used.

As these and our previous examples indicate, causal *von*'s internal argument takes on the thematic role of a non-volitional cause; cf. the notion of a "causer," e.g., in Alexiadou & Schäfer (2006) and Schäfer (2009). We may conclude that both the eventive and the stative reading of causal *von* express a non-agentive, direct causal relationship between a cause and its effect.

Turning to the differences between eventive and stative causal *von*, we want to propose that they can be accounted for in terms of Shibatani's (1973) distinction of ballistic vs. continuous causation; see also Talmy (1976), van Lambalgen & Hamm (2005), and Copley & Harley (2012). Shibatani (1973) differentiates between two types of causation, based on their temporal properties. In the case of ballistic causation, the cause precedes the effect, whereas with continuous causation, cause and effect occur almost simultaneously. Take as an illustration the sentences in (28) and (29).

(28) Paul threw the box into the water. ballistic causation

(29) Paul dragged the box into the water. continuous causation

In (28) the causing event, i.e., Paul's throwing the box, precedes the caused event, i.e., the box moving into the water. This is what Shibatani calls ballistic causation. In (29), Paul's dragging the box takes place more or less simultaneously with the event of the box moving into the water. This is a case of continuous causation.

In the following we want to propose that the distinction between ballistic and continuous causation may be fruitfully applied to the case of causal *von*. More specifically, we will combine Shibatani's opposition, which up to now has only been considered in the realm of events, with an ontological distinction between events and tropes. Based on this, the eventive reading of causal *von* will be analyzed in terms of a ballistic causation between events, whereas causal *von's stative* reading corresponds to a continuous causation between tropes.

4 Event and Trope Causation

In current linguistic theorizing, causation is generally considered to be a relation that holds between events, e.g., Eckardt (2000), Hobbs (2005), and Vecchiato (2011) among many others. This relation is typically represented by a primitive CAUSE (e_1, e_2), which is meant to express that the occurrence of a causing event e_1 causes a resulting event e_2 to occur. See Copley & Wolff (2014) for a recent overview of the linguistic and philosophical literature on causation. More recently, Moltmann (2007, 2009, 2013) has argued in a series of papers for the ontological category of tropes as concrete property manifestations in an individual. According to Moltmann, tropes, such as, e.g., the redness of an apple or Mary's paleness, share with events the property of being causally efficacious. This is illustrated by sentence (30), which identifies Mary's paleness as the cause for the shock; see Moltmann (2013: 301).[13]

[13] See Maienborn (2015) for an overview of the ontological properties of events and tropes as opposed to (certain) states.

(30) Mary is shockingly pale.

In short, tropes act as implicit arguments of adjectives and can be referred to by adjective nominalizations such as German *Schönheit* 'beauty' and *Zufriedenheit* 'satisfaction' or English *redness*, *happiness*, and *paleness*. Trope arguments are targeted by modifiers such as the ones in (30) and (31). As Moltmann (2013: 300) points out, "these modifiers represent precisely the kinds of properties that tropes are supposed to have, such as properties of causal effect, of perception, and of particular manifestation."

(31) a. Mary is visibly / profoundly happy.
b. Mary is extremely / frighteningly pale.

Adopting Moltmann's notion of tropes, we want to propose that causation holds either between events or between tropes as indicated by the causal patterns in (32). Maienborn (2015) argues that the reason why it is just events and tropes that enter causal relations lies in their ontological properties. Both events and tropes are spatiotemporal particulars. This physical concreteness is what ensures their causal efficacy.

(32) a. CAUSE (e1, e2) with e1, e2 as variables over events
b. CAUSE (r1, r2) with r1, r2 as variables over tropes

In the following, we will show that the findings of our corpus study provide further empirical support for the assumption of the two causal patterns in (32). The causal preposition *von* codes both the eventive and the stative causal relationship as indicated by (32). First, we will discuss the sortal properties of *von*'s arguments and see how they can be harmonized with the restrictive requirements of (32). And then we will turn to an implementation of the conditions on spatiotemporal contiguity imposed by direct causation in the ballistic and the continuous variants.

As for the sortal properties of *von*'s arguments, let us start with the eventive case. Our corpus study showed that *von*'s internal argument is in fact predominantly of type event. What about the non-eventive cases? They can be argued to involve coercion such that a suitable event is derived on the basis of the given object. Take the sentences in (33) as illustrations.

(33) a. … ich war noch satt von der Pizza. [265]
I was still full from the pizza

b. Der Raum war halb dunkel und feucht von vergangenen Waschtagen. [174]
The room was half dark and damp from past wash-days

In (33a), the pizza itself cannot be the cause for being full. Something must have happened – an event in which the pizza was involved. A plausible cause for being full that is related to a pizza is an eating-event. This provides the most natural interpretation for (33a). (33b) illustrates the case of a temporal object. Although the compound *Waschtage* ('wash-days') itself is non-eventive, it embeds an eventive expression as a non-head that hints at the true cause: the washing on past days has caused the room to become damp. From these considerations we may safely conclude that causal *von*'s eventive reading is based in general on a causing event e_1 that is either explicitly introduced or pragmatically accommodated via *von*'s internal argument.

What about the resulting event e_2? Our copula sentences do not express events but states. At first glance, this might pose a problem for our assumption. Yet, throughout our discussion of the eventive causal *von* data it has become clear that the copula sentence must be interpreted not as a simple state but as a result state – more specifically a result state that is initiated by the causing event. That is, the overtly expressed state is coerced into a result state of a hidden eventive BECOME operator. Take the pizza case in (33a) as an example. Eating the pizza did not simply cause a state of being full, but the sentence implies that this state did not obtain before. Hence, eating the pizza caused a change of state from being not full to being full, i.e., an event (with the result state holding at the time of the predication). Under this assumption, all eventive readings of causal *von* conform, in fact, to the pattern CAUSE (e_1, e_2).

Let us turn to the stative case. The resulting trope r_2 is provided by the adjectival predicate. So far, so good. But what about the causing trope r_1? Our corpus study attested some instances of trope-denoting internal NPs such as (34):

(34) Die Luft ist schwer von Blütenduft. [358]
The air is heavy from blossom-scent

In (34), a trope of the blossoms, namely their particular scent, is the cause for the air's heaviness. What is striking, however, is that in 95% of the stative cases the internal NP denotes an object instead of a trope, cf. (35), repeated from (14):

(35) a. Seine Kleider waren stets weiß vom Mehlstaub … [339]
His clothes were always white from.the flour-dust

b. Ihre schwarze Jacke ist nass von Tränen. [102]
Her black jacket is wet from tears

In all these cases, it is not the object itself that acts as a cause, but some concrete property manifestation in that object. That is, the causing trope r_1 is inferred via the given object. For instance, what causes the whiteness of the clothes in (35a) is the whiteness of the flour dust. And the cause for the jacket being wet in (35b) is the wetness of the tears. So, we may safely conclude that all stative readings of causal *von* indeed follow the pattern CAUSE (r_1, r_2). Nonetheless, we should provide an explanation for the puzzling fact that almost all cases of trope causation involve coercion of the causing trope from a given object. The reason lies in the ontological nature of tropes. They are property manifestations in an individual, and as such they do not exist independently of their bearers. That is, tropes can best be identified through their bearers. Note that in those cases where the cause is given directly by a trope expression, this always involves additional information about the bearer of the trope; cf. the compound *Blütenduft* ('blossom-scent') in (34). This explains the predominance of internal arguments of type object in the stative reading of causal *von*. They are the bearers of the causing trope r_1. On the basis of the bearer and the resulting trope r_2, r_1 may be readily inferred as being of the same type and sufficiently similar to r_2; cf. our inference pattern in (5). There is a small margin of freedom in inferring the relevant trope though. In (36), for instance, the adjective *bleich* ('pale') carries a selectional restriction for human beings. This restriction is not met by dust. Accordingly, the dust's grey color is identified as r_1.

(36) Die Menschen sind bleich vom Staub der zerborstenen Gebäude … [294]
The people are pale from.the dust of.the burst buildings

In sum, the two patterns of event causation and trope causation that we proposed in (32) provide the right kind of generalization for the sortal type of causal *von*'s arguments. Following this, we may now turn to spelling out the conditions on spatiotemporal contiguity that are imposed by direct causation in the ballistic and the continuous variants.

As we have seen in the previous section, causal *von*'s expression of direct causation among events follows the ballistic pattern. The respective conditions on the spatiotemporal contiguity of e_1 and e_2 are formulated in the following ontological axioms.[14] The causing event e_1 precedes immediately the resulting event e_2; cf. (37a).[15] And there is some kind of physical contact between the two events. This is formulated in (37b) in terms of spatial contact. For the case of eventive causal *von*, this amounts to demanding that the bearer of the resulting trope must be in spatial contact to e_1, i.e., by taking part in e_1.

(37) Spatiotemporal contiguity in ballistic causation: (eventive reading)
a. $\forall e_1 \forall e_2$ CAUSE $(e_1, e_2) \rightarrow \tau(e_1) \supset\subset \tau(e_2)$ $\supset\subset$: temporal abutment
b. $\forall e_1 \forall e_2$ CAUSE $(e_1, e_2) \rightarrow p(e_1) \circ p(e_2)$ $\circ$: spatial contact; p: place function

The axioms in (38) account for the respective conditions in the stative case: the temporal extension of the resulting trope r_2 lies within the temporal extension of the causing trope r_1; cf. (38a). And r_2's spatial extension is included by the spatial extension of r_1; cf. (38b).

(38) Spatiotemporal contiguity in continuous causation: (stative reading)
a. $\forall r_1 \forall r_2$ CAUSE $(r_1, r_2) \rightarrow \tau(r_1) \supseteq \tau(r_2)$
b. $\forall r_1 \forall r_2$ CAUSE $(r_1, r_2) \rightarrow p(r_1) \supseteq p(r_2)$

The characteristic holistic effect observed with the stative reading of causal *von* is accounted for by the axiom (38b). Take as an example the case of the red leaves from sentence (4). According to (38b), the spatial extension of the redness of the square must fall within the spatial extension of the redness of the leaves. Given that the subject referent is indivisible with respect to the main predication (see Löbner's (2000) presupposition of indivisibility), this implies that the leaves must be holistically located on (relevant parts of) the square. Thus, we are able to derive the holistic interpretation of stative causal *von* on the basis of independently motivated assumptions concerning spatiotemporal contiguity restrictions on trope causation. Our explanation shares with Rapoport (2014) the assumption that the source of the holistic interpretation is to be found in the semantics of the preposition. Rapoport has argued for the parallel case of *with* (e.g., *The floor was black with ants*.) that the holistic effect is due to the particular semantics of the preposition *with* (rather than being construction specific). With (38b) we propose an ontologically grounded implementation of this assumption.

[14] Our formulation of the conditions on spatiotemporal contiguity for the eventive case is similar in spirit to Vecchiato's (2011: 170) definition: "A causal pair of events (*e, e'*) is spatially proximate if and only if at least one of the participants in *e* is spatially proximate to at least one of the participants in the effect *e'*. A causal pair of events (*e, e'*) is temporally proximate if and only if *e'* occurs immediately after *e*."Vecchiato does not take into account stative causation though.

[15] See, e.g., Kamp & Reyle (1993) for the temporal relation of abutment.

5 Conclusion

Causal *von*-modifiers in adjectival copula sentences provide interesting insights into the rarely discussed case of stative causation. Our corpus study provided rich empirical data on the eventive/stative ambiguity of causal *von*-modifiers. They were shown to express a narrow notion of non-agentive, direct causation that follows either a ballistic or a continuous pattern. Based on this, we developed a proposal that accounts for the observed interpretive properties of causal *von* by combining three independent resources: (a) ontological properties of tropes and events as causally efficacious categories; (b) spatiotemporal contiguity conditions imposed by direct causation; and (c) integration of coercive mechanisms into meaning composition. Interpretive peculiarities, such as the holistic effect observed with the stative reading of causal *von*, follow from these assumptions straightforwardly. All in all, our account emphasizes the underlying similarities between causal *von*'s eventive and stative readings, which differ only with respect to the sortal type of the causal relata. Furthermore, our corpus study provided first empirical evidence hinting at different syntactic integration sites for the stative and eventive *von* within the AP. This opens up a path for future investigations to pursue a strictly compositional derivation of *von*'s stative and eventive readings.

6 Acknowledgments

This paper is based upon work supported by the Deutsche Forschungsgemeinschaft (project A1 of the SFB 833 "The Construction of Meaning" at the University of Tübingen). We would like to thank our project members, Sebastian Bücking, Frauke Buscher, Julia Lukassek, Anna Prysłopska, and Sarah Zobel, as well as the audience at IATL 30 for comments and feedback. We are particularly grateful to Adam Kilgarriff, Janina Kopp, Niels Ott, and Siva Reddy for their advice and support with the corpus search. Thanks also go to our student assistant Ekaterina Laptieva for her help with the corpus annotation.

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