

Cataphoric resolution of projective content: The case of occasion verbs *

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Abstract We present evidence from three rating experiments showing that what we call *occasion verbs* (e.g., *thank*, *criticize*, *congratulate*) allow for the cataphoric resolution of projective content more broadly than trigger types discussed in previous research. Experiments 1 and 2 used methods established by Tonhauser, Beaver & Degen (2018) to show that occasion verbs do indeed pattern with other well-known triggers with respect to projectivity and at-issueness. Furthermore, these experiments provide evidence that occasion verbs — as opposed to a number of other triggers — allow for the cataphoric resolution of projective content in a separate clause in subsequent discourse. Experiment 3 compared the filtering behavior of occasion verbs with that of factive and aspectual triggers for conjunctions in the antecedent of conditionals (*if p and q, then r*; Mandelkern et al. 2020). The results show that while factive and aspectual verbs show left-to-right filtering asymmetry, occasion verbs display symmetric filtering, that is, right-to-left and left-to-right. Taken together, these results provide evidence that occasion verbs constitute a species not yet observed within the “zoo” of triggers of projective content.

Keywords: triggers of projective content, implicit causality, occasion verbs, cataphoric resolution

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1 Introduction

Linguistic expressions associated with projective content are well-known to be highly diverse. Thus, on Levinson’s (1983) list, called the “zoo of presupposition triggers” by Karttunen (2016), we find definite descriptions and clefts, particles and adverbs like *too* and *again*, as well as, for instance, verbs of change of state (*stop*) or factivity (*know*). While some of these are well-studied, both theoretically and, more recently, also experimentally, the status of other triggers is less well established. One important reason for this is that it has turned out to be difficult to identify a feature beyond projectivity uniting all of them (see, in particular, Tonhauser et al. 2013). In this paper, we propose to add to the diverse “zoo” yet another class of triggers that we have chosen to characterize as *occasion verbs*. As we show, these verbs are special in that they allow their projective content to be resolved cataphorically, that is, in subsequent discourse.

One verb belonging to the class of occasion verbs is *congratulate*:

- (1) Peter congratulated Mary. She had won a race.

We assume the projective content associated with occasion verbs to be an implication that an eventuality (cf. Bach 1986) prior to the action described by the occasion verb gave the agent reason to act the way they did. Thus, a speaker of (1) is committed to the content that Peter’s act of congratulating was caused by some eventuality associated with Mary. Such eventualities may be characterized as *occasions* for the agent’s action. Correspondingly, we refer to the implication of occasion verbs as the *occasion implication*.

We will provide experimental evidence that occasion verbs should indeed be considered as triggers of projective content. Furthermore, we will show that this content may be resolved cataphorically, that is, in subsequent discourse. This goes against standard assumptions of incremental resolution of projective content. While we are not questioning this as a general preference, we contend that studying occasion verbs more closely may contribute to our understanding of how and when projective content actually projects.

The paper is organized as follows. Section 1.1 introduces occasion verbs, while Section 1.2 presents previous theoretical and experimental research that we draw upon in arguing for the status of occasion verbs as expressions associated with projective content. Following this presentation, Sections 2 through 4 provide evidence from three rating experiments on both the projective nature of occasion verbs and the availability of cataphoric resolution

for their projective content. In Section 5 we discuss our findings and possible consequences for theoretical assumptions on the resolution of projective content. Section 6 concludes the paper.

1.1 Occasion verbs

A subset of the verbs that belong to the class of occasion verbs such as *criticize* and *praise* have previously been discussed as members of Fillmore's (1969) class of judgment verbs (see also, in particular, Fabricius-Hansen & Sæbø 2011, McCawley 1975). Interestingly, though, judgment verbs constitute a species of triggers of projective content that are rarely discussed and even claimed to have made it onto Levinson's (1983) list of triggers "by mistake" (Karttunen 2016: p. 791).

While occasion verbs have not been much discussed in theoretical linguistics, they have been extensively studied in psycholinguistics as a sub-class of so-called *Implicit Causality* verbs. More specifically, occasion verbs have been referred to as 'agent-evocator verbs' (Au 1986, Rudolph & Försterling 1997) or, alternatively, 'agent-patient verbs with a presupposition' (Bott & Solstad 2014, 2021, Solstad & Bott 2023). They include a number of the aforementioned judgment verbs, but also verbs not discussed by Fillmore like *congratulate*, *reward* and *thank* (see, in particular, Austin's (1962) class of *behabitives*).

Implicit Causality verbs are interpersonal, mostly transitive predicates that have two particular properties of interest here. Most prominently discussed in previous research is their *coreference bias* (e.g., Garvey & Caramazza 1974, Brown & Fish 1983, Ferstl, Garnham & Manouilidou 2011): When participants are prompted to provide explanations for simple sentences with proper name arguments as in (2), they show a strong tendency to make primary reference to one of the arguments over the other (typically around 80 to 90%, cf. Au 1986, Brown & Fish 1983, Ferstl, Garnham & Manouilidou 2011, Hartshorne & Snedeker 2013, Solstad & Bott 2022, 2023):

- (2) a. Peter congratulated Mary because ... she won the race.
b. Peter annoyed Mary because ... he was very noisy.

The preference for subject or object coreference is mostly seen as a function of verb class (Au 1986, Brown & Fish 1983, Crinean & Garnham 2006, Hartshorne & Snedeker 2013, Rudolph & Försterling 1997, Solstad & Bott 2023). While occasion verbs like *congratulate* typically trigger continuations

about the object argument (Solstad & Bott 2023 found 92% of continuations on average to refer back to the object), psychological verbs from the stimulus-experiencer class of Implicit Causality verbs like *annoy* are predominantly followed by continuations about the subject (87% average reference to the subject according to Solstad & Bott 2022).

The second property of particular importance in the present study involves a *coherence bias* (Bott & Solstad 2014, Kehler et al. 2008, Solstad & Bott 2022, 2023): When prompted to provide continuations for simple sentences without a connective, see (3), participants show a strong preference (around 60%) to provide an *Explanation* as in (3a) over establishing other discourse relations (3b).¹

- (3) Peter congratulated Mary. ... ↪
- | | |
|----------------------------|--------------------|
| a. She had won a race. | <i>Explanation</i> |
| b. She was very flattered. | <i>Result</i> |

Evidence for coreference and coherence biases has been found across languages and modalities (Hartshorne, Sudo & Uruwashi 2013, Bott & Solstad 2014, Goikoetxea, Pascual & Acha 2008, Frederiksen & Mayberry 2021). The nature of Implicit Causality is still under debate, however, with accounts ranging from grounding it primarily in world knowledge (Pickering & Majid 2007, van den Hoven & Ferstl 2018) to lexical semantic approaches in a broad sense (Crinean & Garnham 2006, Hartshorne & Snedeker 2013, Bott & Solstad 2021). There are few elaborate linguistic accounts of the possible theoretical basis of the biases (cf. e.g., Bott & Solstad 2014, 2021, Solstad & Bott 2022, van den Hoven & Ferstl 2017), with previous research mainly focusing on the coreference biases as such.

Identifying major lexical semantic features that may contribute towards coreference and coherence biases, Bott & Solstad (2014) proposed to account for these biases via one common mechanism. In particular, they argued that the bias towards providing an explanation (3) constitutes the fundamental property of Implicit Causality verbs, the coreference bias (2) being derived from it. According to their *Empty Slot Theory* (Solstad & Bott 2013, Bott & Solstad 2014, 2021, Solstad & Bott 2022, 2023), Implicit Causality verbs trigger the above preferences because they are semantically underspecified with re-

¹ In comparison, agent-patient verbs like *verjagen* ‘chase away’ or *vergiften* ‘poison’, which are not projective in the sense of occasion verbs, are followed by explanations in approximately 30% of the cases (Solstad & Bott 2023).

gard to an eventuality that is causally related to the eventuality described by the verb and specifically associated with one of the two arguments. The main point is that in the minimal context of *Peter congratulated Mary*, with no prior knowledge about the participants and only general domain knowledge to rely on, participants follow an overall strategy of specifying underspecified content (or, “filling empty slots”, in Bott & Solstad’s (2014) terminology).

Bott & Solstad (2014) proposed to analyze the underspecified content of occasion verbs as a presupposition (see also Au 1986, Fabricius-Hansen & Sæbø 2011, Fabricius-Hansen 2017). They applied the Family-of-Sentences test (Chierchia & McConnell-Ginet 1990) in determining which verbs to include in this verb class. Their intuition was that the occasion implication projects in all environments in (4):²

- (4) a. It is not the case that Peter congratulated Mary.
- b. Did Peter congratulate Mary?
- c. Perhaps Peter congratulated Mary.
- d. If Peter congratulated Mary, John will send her some flowers.

Implication: an eventuality prior to the action described by the occasion verb gave the agent reason to act

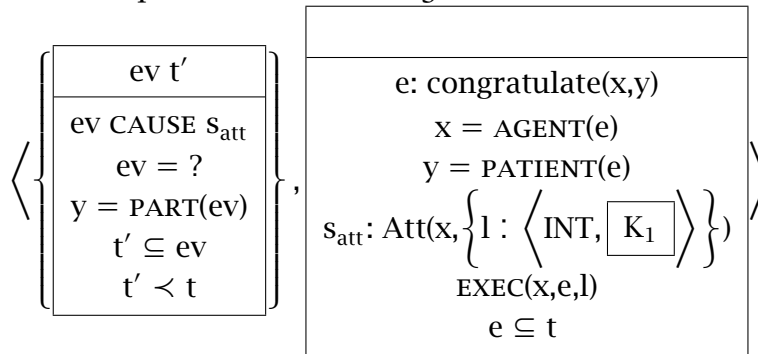
The present study provides experimental evidence for the projectivity of the occasion implication, complementing the theoretical analysis in Bott & Solstad 2014. While we argue that the occasion implication has properties so far not observed in research on projective contents, we are uncommitted with regard to the precise characterization of this content. We therefore refer to occasion verbs merely as *triggers of projective content* (e.g., Tonhauser et al. 2013, Tonhauser, Beaver & Degen 2018).

The Discourse Representation Structure in (5) represents a lexical entry for *congratulate*, formalizing central aspects discussed above (for details on the general representation format, see Kamp, van Genabith & Reyle 2011). The assertive content is contained in the right-hand box, while the projective content occurs in the curly brackets on the left. Importantly, the use of this format does not constitute a commitment to an incremental left-to-right resolution of projective content, although this is mostly assumed to be the

² Enriching the Implicit Causality production paradigm with Family-of-Sentence environments, Gerle et al. (2017) argued against the analysis of occasion verbs in Bott & Solstad 2014. We therefore think it is particularly important to apply methods developed independently in experimental research on projective content.

case in Discourse Representation Theory (Kamp, van Genabith & Reyle 2011). Quite to the contrary, we take this representation to be compatible also with resolution mechanisms that allow for cataphoric resolution.

(5) Lexical representation for *congratulate*:



According to the right-hand part of (5), congratulating is represented as an event e involving an agent x and a patient y . The intentionality of the agent's action is represented by the agent x being in an intentional attitudinal state s_{att} (abbreviated as K_1) in combination with the relation $EXEC$, which represents the execution of the agent's intention l by performing e (see Kamp 2007).

The projective part of the representation includes an underspecified eventuality ev involving the object argument y of *congratulate* as one of its participants (a notion intended to be underspecified with regard the nature of the particular semantic role involved). This eventuality may be the event of winning a race, the state of having ones birthday at t' and so on. Importantly, this eventuality temporally precedes or overlaps with the event time t of congratulating ($t' < t$) and constitutes a cause of the agent's attitudinal state (ev CAUSE s_{att}). As a cause of the agent's intention to act, the implicated eventuality can be considered an external reason of the agent, that is, a reason independent of the agent's attitude(s) (cf. the analysis of reasons as causes of intentions in Solstad 2010).

The representation in (5) does not include the proposed projective implications of judgment verbs discussed by Fillmore (1969) and McCawley (1975). Fillmore (1969: p. 105) argued that the object of *criticize* may be considered "responsible" for the implicated eventuality (the "situation", in Fillmore's words). He considered this responsibility to be a separate presupposition of *criticize*, whereas we only take the object argument to be a participant in the implicated eventuality with no assessment of responsibility (see Fabricius-

Hansen & Sæbø 2011). Furthermore, Fillmore (1969: p. 105) included a presupposition that the eventuality be “actual”, that is, factive. While we’re assuming that any proper act of congratulating must include at least a sincere belief as to the occasioning eventuality on part of the *agent*, we do not assume that the *speaker* must be committed to the factuality of the eventuality. What the speaker is committed to is rather that the agent acted with reason. This distinction is crucial in contextualizing the verdict of Karttunen (2016). Expelling judgment verbs from the “zoo” of triggers, Karttunen argued that uttering *John criticized Bill for not answering Harry’s letter* does not commit the speaker to share the (likely) beliefs of John, the agent argument, and hence should not be considered projective. While we agree that the speaker need not share the beliefs of John, she should commit to there being a reason for John’s action. Consequently, the occasion implication is not subject to Karttunen’s critique, we believe.

Furthermore, the causal relation between the implicated eventuality and the agent’s intentional attitudinal state must be enriched with information on what constitutes an adequate reason for executing a particular action such as praising or criticizing. Should a person only be praised for doing all their tasks as opposed to merely some of them? Does doing nothing make you deserve criticism? While we cannot go into detail here, it is important to note that the causal relation between the implicated eventuality and the attitudinal state of the agent cannot be mechanistic (it is, after all, an attitudinal state), since other attitudes of the agent or situational aspects may weigh heavier than any external reason. Consider the following examples:

- (6) a. Mary didn’t praise John for finishing half the job because she was mad at him.
- b. Mary didn’t criticize John for not finishing the job because she loved him.

We would argue that there is a potential occasion for praising (6a) or criticizing (6b) and that the occasion implication does project. For reasons related to other attitudes of the agent, however, the threshold for acting is not met. Importantly, this should not be encoded in the lexical representation, but rather be handled in a causal model which also takes into account the particularities of the situation at hand.³

³ An anonymous reviewer pointed out that there are interesting parallels between our analysis of occasion verbs and the analyses of implicative verbs (e.g., *manage*, *dare*) in Baglini & Francez 2016 and Nadathur 2023. Nadathur (2023: p. 312) argued that implicative verbs “in-

A further issue raised by an anonymous reviewer relates to the apparent explicit cancellation of the occasion implication on the one hand (7a) and “generic” uses on the other (7b):

- (7) a. John thanked his servant for no (apparent) reason.
- b. John criticized his servants all the time.

To us, (7a) does not involve cancellation of the occasion implication, but rather expresses — on one possible interpretation — that the speaker does not consider John’s reason for thanking to be adequate. If John were to thank someone without a reason for doing so, this would fail to meet the preconditions for *thank* and thus constitute a mere performance involving an utterance like “I, John, thank you, my servant” (for detailed discussion, see Fabricius-Hansen & Sæbø 2011, Fabricius-Hansen 2017). (7b) represents a different case. Here, the agent’s attitude may have its causes, but given the generic activity of criticizing none of these may seem important enough to trigger a *Why?* question with regard to an external reason.

As mentioned above, the overlap between occasion verbs and Fillmore’s (1969) judgment verbs is only partial. We share with McCawley (1975) the skepticism towards considering all judgment verbs to be projective in the relevant sense here. We have used a simple additional diagnostic to identify occasion verbs: Since the occasion implication crucially involves a causal relation between the implicated eventuality and the agent’s intention, we assessed whether an external reason associated with the object argument could be included in a subsequent *because* clause, as in (2a). This excludes, for instance, *accuse*, which McCawley (1975) argued to be significantly different from *criticize*.

- (8) #Mary accused Peter because he had stolen her money.

As we argue in the General Discussion, it is exactly this explanatory property of occasion verbs that makes them prone to allow for the cataphoric resolution of the occasion implication.

Finally, it may be noted that all occasion verbs allow for the eventuality to be specified in a prepositional phrase, as in (9):

roduce a salient prerequisite, which is presupposed to be *causally necessary* and *causally sufficient* for the realization of the complement”, such as being daring for *dare*. We cannot in any way do justice to these analyses here, suffice it to say that we assume that the implicated eventuality of occasion verbs as a ‘prerequisite’ still survives negation (and not just the causal relation as such).

- (9) a. *Maria kritisierte Peter für den schlechten Job.*
'Maria criticized Peter for doing a poor job.'

Most German occasion verbs investigated in this paper allow for modification by a *für* 'for' phrase, which may be considered a prepositional object introducing the projective content. We hypothesize that the high degree of uniformity observed with regard to coreference and coherence biases in production experiments may be linked to the fact that this argument is left implicit in prompts like (2) and (3). See Bott & Solstad 2021 for experimental evidence in support of this hypothesis.

Summing up the above, occasion verbs display three properties of importance for this study. First, the occasioning event may be introduced in a *because* clause (8). Second, explicit explanations are associated with a very strong coreference bias to the object argument (2). And, finally, occasion verbs display a strong explanatory coherence bias in the absence of an explicit connective (3).

An open question from previous research is how special occasion verbs are as a sub-class of Implicit Causality verbs. After all, psychological stimulus-experiencer verbs like *annoy* are associated with comparable coreference and coherence biases (Bott & Solstad 2014, Kehler et al. 2008, Solstad & Bott 2022), see (2b):

- (2b) Peter annoyed Mary because ... he was very noisy.

One may therefore ask whether all Implicit Causality verbs display properties of projectivity, or, alternatively, something else is responsible for the patterns observed in the above.

While *annoy* (2b) also involves underspecified semantic content, this content is not taken to be projective by Bott & Solstad (2014, 2021). Rather, the particular pattern of explanations for verbs like *annoy* is assumed to be triggered by the underspecification of one argument (see Figure 1 in Bott & Solstad 2021): The biased subject argument of *annoy* is analyzed as being underlyingly propositional in nature (involving a predicate variable, cf. Cheung & Larson 2015, Bott & Solstad 2021) and thus underspecified when realized only by means of a proper name like *Peter* in (2b). One piece of evidence in favor of this underspecification analysis is the fact that the stimulus argument may also be realized as a (*that*) clause (Bott & Solstad 2014, Cheung & Larson 2015). No such alternation is found for the object of occasion verbs, which involve no embedding. Detailed discussion can be found in Bott & Solstad 2014, 2021 and Solstad & Bott 2022. Experiment 2 provides experimental evidence

that occasion verbs differ from psychological verbs in that only the former clearly cluster with other well-established triggers of projective content.

1.2 Projective content

We focus on properties that have been investigated in experimental research on projective content. Our point of departure is work by [Tonhauser et al. \(2013\)](#) and [Tonhauser, Beaver & Degen \(2018\)](#), which constitutes the theoretical and empirical background of our study. We first discuss the notions of projectivity and projective variability before turning to issues relating to the context dependence and filtering behavior of projective contents.

1.2.1 Projectivity and projective variability

Content is considered to be projective by [Tonhauser et al. \(2013\)](#) in a particular utterance context if the speaker would typically be committed to it even when the expression that the content is associated with occurs in an entailment-canceling environment as discussed above for the Family-of-Sentences contexts (4).

To investigate projectivity experimentally, [Tonhauser, Beaver & Degen \(2018\)](#) elicited graded judgments with respect to speaker commitment and at-issueness (see below). Participants were asked to imagine that they overhear a speaker ask someone a polar question. Their task was to judge to which extent the person asking the question would be committed to the (potentially) projective content embedded therein. Thus, for the factive implication associated with *know*, participants would answer the question in (10b), using a slider ranging from “Yes” to “No” to allow for graded ratings of speaker commitment.

- (10) a. Patrick asks: Does Billy know that Martha has a new BMW?
 b. **Projectivity question:**
 Is Patrick certain that Martha has a new BMW?

A positive response was taken to indicate that the speaker was committed to the relevant projective content (to varying degrees). Importantly, the gradability inherent in this way of measuring projectivity adequately reflects previous arguments that projective contents display projective variability ([Abrusán 2016](#), [Abusch 2010](#), [Beaver, Geurts & Denlinger 2021](#), [Jayez et al. 2015](#), [Karttunen 1971](#), [Schwarz 2019](#), [Tonhauser, Beaver & Degen 2018](#), [Xue &](#)

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Onea 2011). Thus, Karttunen (1971) argued that among factive verbs, the associated content of *regret* is more projective than that of *discover* in the sense that *discover* more easily allows for ‘non-factive’ interpretations (Karttunen 1971: p. 63):

(11) Did you regret/discover that you had not told the truth?

According to Karttunen (1971), *regret* commits the speaker more strongly to the view that the addressee had not told the truth, while *discover* may be interpreted as an information question. Experimental and corpus research has since shown that different triggers display projective variability. Tonhauser, Beaver & Degen (2018) found significant projective variability across trigger classes. Furthermore, Degen & Tonhauser (2022) even found significant within-class variability for factive predicates. Moreover, Smith & Hall (2014), Sieker & Solstad (2022; based on Sieker 2022) and Hofmann, de Marneffe & Tonhauser (forthcoming) observed projective variability for a number of triggers with respect to two different Family-of-Sentence contexts (see also Karttunen 1971). Other factors of relevance include properties of the subject (de Marneffe, Simons & Tonhauser 2019, Schlenker 2010) or prosody (Abrusán 2011).

In explaining this variability in projection, Simons et al. (2010) proposed that the projectivity of content is derived from at-issueness. Content projects to the extent that it is not-at-issue in regard to the Question under Discussion targeted by an utterance (cf. Roberts 1996). Beaver et al. (2017) captured this idea in the *Projection Principle*, which was slightly reformulated as the *Gradient Projection Principle* by Tonhauser, Beaver & Degen (2018: p. 499) to take the gradability of projectivity into account: “If content *C* is expressed by a constituent embedded under an entailment-canceling operator, then *C* projects to the extent that it is not-at-issue.”

One way Tonhauser, Beaver & Degen (2018) operationalized the at-issueness of projective content was by asking participants to provide a graded answer to polar questions for the BMW ‘dialogue snippet’ discussed above (10a):

(12) **At-issueness question:**

Is Patrick asking whether Martha has a new BMW?

This diagnostic assumes that “the context set is more likely to be partitioned by at-issue content and its negation than by not-at-issue content and its nega-

tion” (Tonhauser, Beaver & Degen 2018: p. 501). A negative answer would indicate that the projective content is *not*-at-issue, and thus displays a higher degree of projectivity. One of the important findings in Tonhauser, Beaver & Degen 2018 is that projectivity and at-issueness are negatively correlated for triggers of projective content, as predicted by the Gradient Projection Principle. In the present study, we therefore compare occasion verbs to more well-established triggers in terms of both projectivity and at-issueness.

1.2.2 Context dependence

Beyond the basic property of projectivity (and projective variability), triggers vary to the degree that their projective content must be given in the utterance content, a property that also reflects how easily projective content can be accommodated (e.g., Tonhauser et al. 2013: p. 80). To account for this kind of context dependence of projective content, Tonhauser et al. (2013) classified triggers according to whether they impose a *strong contextual felicity constraint* on their utterance context.

Expressions associated with projective content that impose a strong contextual felicity constraint on their contexts require their projective content to be part of the interlocutors’ common ground at the moment of utterance. Tonhauser et al. (2013: p. 76) provide the following definition of strong contextual felicity: “If utterance of trigger t of projective content m is acceptable only in an m -positive context, then t imposes a strong contextual felicity constraint with respect to m .” An m -positive context “is an utterance context that entails or implies m ” (Tonhauser et al. 2013: p. 75). Contexts that neither entail nor imply m or $\neg m$ are characterized as m -neutral.

The notion of strong contextual felicity plays a crucial role for occasion verbs. Experiments 1 and 2 provide evidence that occasion verbs do indeed seem to require their contexts to be m -positive, as witnessed by the contextual infelicity of (13), if uttered out of the blue:

(13) Peter congratulated Mary.

Occasion verbs turn out to behave differently from triggers discussed under the notion of strong contextual felicity by Tonhauser et al. (2013), however, since explanations may also be provided in subsequent context, see (1):

(1) Peter congratulated Mary. She had won a race.

In what follows, we argue that occasion verbs do indeed impose a contextual felicity constraint on their context, although not quite in the sense of Tonhauser et al.'s (2013) strong contextual felicity constraint. Going beyond Tonhauser et al. 2013, we differentiate between the *m*-positive contexts discussed therein and subsequent contexts including the projective content *m*. While the former are characterized as *m-anaphoric*, we refer to the latter as *m-cataphoric*, as in (1).

1.2.3 Cataphoric resolution and filtering behavior

The final property of central importance in the present study is that of *cataphoric resolvability*, which was not investigated by Tonhauser et al. (2013) and Tonhauser, Beaver & Degen (2018). The motivation for assuming this property to be of relevance for occasion verbs stems from the findings from discourse continuation experiments as discussed above, see (3). Implicit Causality verbs seemingly lead to an expectation that an explanation will follow (Kehler et al. 2008, Bott & Solstad 2021, Solstad & Bott 2022, 2023).

However, if (1) involves the resolution of projective content, we are dealing with a case of *cataphoric* resolution, that is, subsequent to the trigger. An obvious challenge to this approach is that such resolution does not belong to the standard assumptions about triggers of projective content. Thus, for the treatment of the projective content of complex expressions involving conjunction, disjunction or conditionals, an incremental, left-to-right filtering asymmetry has been assumed (cf., e.g., Karttunen 1974, Stalnaker 1974, Heim 1983). For the conjunction *and*, for instance, material in the left conjunct may act as a filter for a trigger in the right conjunct (Karttunen 1974), whereas material to the right of a trigger may not. This could account for the infelicity of (14b) as compared to (14a) for the trigger *stop*, where *St* is the sentence containing the (relevant) trigger and *Sp* contains the projective content associated with *St*.

- (14) a. [_{Sp} Peter used to smoke] and [_{St} he has stopped smoking].
 b. #[_{St} Peter has stopped smoking] and [_{Sp} he used to smoke].

It is commonly assumed that the projective content *Sp* of *St* is filtered out in (14a), but projects in (14b), which is why the latter sequence is infelicitous.

However, in a debate going back to Partee's bathroom example, Brasoveanu & Szabolcsi (2013), Kalomoiros (2024), Rothschild (2008), and Schlenker (2009, 2010), among others, have argued that there are cases where

right-to-left filtering is possible. Thus, Brasoveanu & Szabolcsi (2013) discuss what they characterize as a *postsupposition* for Hungarian *is* ‘too’, for which the second conjunct in (15) serves to resolve the postsupposition of the first occurrence of *is* ‘too’:

- (15) A is B is elszaladt
 A too B too ran away.
 ‘A as well as B ran away.’ (Brasoveanu & Szabolcsi 2013: p. 55)

Such examples notwithstanding, right-to-left filtering has, however, mostly been taken to be restricted to particular constructions such as disjunctions or conditionals (Schlenker 2008, 2009) and also mostly discussed only for adverbs and particles like *aussie* ‘too’ (Chemla & Schlenker 2012) or *again* (Brasoveanu & Dotlačil 2015). Thus, examples such as (15) aren’t taken as wholesale arguments against a processing mechanism that is basically asymmetric from left to right (for projective content). Approaches upholding asymmetry have rather treated such cases as exceptions. Thus, Hirsch & Hackl (2014) accounted for right-to-left filtering exceptions by means of local accommodation limited to cases involving disjunction. Others have argued that there is a more fundamental difference in the availability of filtering for conjunctions and disjunctions, the former excluding such filtering, but the latter allowing it symmetrically (Kalomoiros 2024, Kalomoiros & Schwarz 2021).

Alternatively, one could assume filtering to be symmetric indeed, and instances such as (14b) to be infelicitous due to informational redundancy (cf. Stalnaker 1978). As far as we are concerned, Schlenker (2009) comes closest to representing such a view in defining a symmetric notion of ‘local context’ which would allow for right-to-left filtering—even for conjunctions. The preference for left-to-right filtering could be viewed as a bias arising from a general preference for asymmetric local contexts, that is, incremental left-to-right processing. For Schlenker (2009), then, right-to-left filtering is never excluded, but rather more or less costly (see also the discussion in Kalomoiros 2024, Kalomoiros & Schwarz 2021).

Previous theoretical research has stressed the need for empirical evidence (Rothschild 2008, Schlenker 2008, 2009) and recent experimental research has indeed provided some evidence in favor of the possibility of symmetrical filtering. Thus, Brasoveanu & Dotlačil (2015; see also Brasoveanu & Dotlačil 2020) found the cataphoric resolution of projective content to be marginally better for conditionals as opposed to conjunctions for the trigger *again*. Fur-

thermore, Chemla & Schlenker (2012) provided evidence that French *aussi* ‘too’ allows for right-to-left resolution in conditionals.

In yet another experimental study, however, Mandelkern et al. (2020) argued that right-to-left filtering is not available for selected factive (*be happy, be aware that*) and aspectual (*continue, stop*) triggers. They investigated configurations where a trigger and its associated projective content are conjoined in the antecedent of a conditional:

- (16) If [_{sp} Mary used to do Jivamukti yoga] and [_{st} she stopped doing yoga], then Matthew will interview her for his story.
(Mandelkern et al. 2020: p. 480)

Mandelkern et al. (2020: Experiment 3) employed a discourse naturalness rating paradigm manipulating explicit speaker ignorance in context. In the crucial conditions, a speaker would initially state her ignorance as in (17) before uttering sentences containing a trigger of projective content:

- (17) Mary always was involved in a lot of sports, but I don’t know whether she ever did any yoga.
(Mandelkern et al. 2020: p. 490)

Whenever the projective content of *Mary stopped doing yoga* projects (*Mary used to do yoga*), this content would be inconsistent with the initial utterance. This should lead to reduced naturalness ratings. Indeed, when (17) was followed by (18), involving only the trigger, a significant drop in naturalness ratings was observed.

- (18) If [_{st} Mary stopped doing yoga], then ...

Now, crucially, a conjunct entailing the projective content has the potential to act as a filter, avoiding a clash with the presumed ignorance in the preceding context (17). And indeed, such filtering seems to take place in sentences like (19) — with the entailed content to the left of the trigger —, since they were rated as natural in comparison to (18).⁴

- (19) If [_{sp} Mary used to do Jivamukti yoga] and [_{st} she stopped doing yoga], then ...

If filtering is symmetric, the conditions involving conjunction should sound natural in either order. However, Mandelkern et al. (2020) found sentences

⁴ This was established via non-projective conditions that we will not discuss here.

with the reverse order of conjuncts (20) — with the entailed content to the right of the trigger — to be rated as low as the condition including only the sentence containing the trigger (18).

(20) If [_{st} Mary stopped doing yoga] and [_{sp} she used to do Jivamukti yoga], then ...

Mandelkern et al. took this to show that no filtering takes place right-to-left for conjunctions in the antecedent of conditionals.

Complicating this picture somewhat, Kalomoiros & Schwarz (2021), who applied the same methods as in Mandelkern et al. 2020, found filtering to be symmetric for the disjunction *or*, as there was no significant difference between left-to-right and right-to-left ordering of trigger and projective content.

In sum, the experimental evidence — in particular the conjunction and disjunction studies by Mandelkern et al. (2020) and Kalomoiros & Schwarz (2021) — suggests a mixed picture. Although the (a)symmetry issue is still unresolved, the results seem to confirm what theoretical studies have proposed: If right-to-left filtering is available, it is heavily constrained.

Enlarging the canvas somewhat, we argue that occasion verbs offer a slightly different perspective on the availability of symmetrical resolution of projective content. The upshot will not be to cast in doubt the general preference for left-to-right filtering. Rather, we take it that occasion verbs display special properties that make them more prone to cataphoric resolution, independent of the construction involved. Thus, occasion verbs allow us to explore the limits of generally assumed mechanisms for the resolution of projective content.

1.3 The present study

We conducted three experiments, the main goal of which was testing the hypotheses that (i) occasion verbs are triggers of projective content, and (ii) this content need not be entailed by preceding context, but may be introduced subsequent to the trigger, that is, resolved cataphorically. To this end, we compared the projective properties of occasion verbs to those of other well-known and well-studied triggers associated with projective content, both in terms of projectivity and with regard to the relative order of a trigger and its associated projective content. On a more minor note, the study also includes

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a comparison with two other sub-classes of Implicit Causality verbs that are argued not to be projective in the sense of occasion verbs (see Section 1.1).

From these goals we derived the following five main research questions underlying our experimental research:

- i. Do occasion verbs display properties of projectivity as compared to well-established triggers of projective content? Relatedly, is the extent of projectivity of this content related to its degree of being not-at-issue? (→ Block 2 of Experiments 1 and 2 aims to answer this question).
- ii. Do occasion verbs impose a strong contextual felicity constraint on their context in the sense of *m*-anaphoricity and *m*-cataphoricity?
(→ Block 1 of Experiments 1 and 2).
- iii. Can the projective content of occasion verbs be resolved in the subsequent context of the trigger, that is, cataphorically? And to what extent is this a feature setting occasion verbs apart from other, more established triggers of projective content?
(→ Block 1 of Experiments 1 and 2).
- iv. Are the same properties found for other Implicit Causality bias verbs not belonging to the class of occasion verbs? (→ Experiment 2).
- v. Do occasion verbs allow for right-to-left filtering of their projective content? To what extent do occasion verbs differ from other triggers of projective content in this regard? (→ Experiment 3).

In Experiments 1 and 2, the same set of 16 occasion verbs were tested along with numerous other, more established triggers of projective content. The experiments consisted of two blocks. Block 1 investigated the triggers' overall contextual felicity and the availability of cataphoric resolution, using a simple, yet new method based on the theoretical discussion in [Tonhauser et al. 2013](#). Block 2 investigated the triggers' projectivity and at-issueness as embedded in polar questions, adopting the experimental paradigm in [Tonhauser, Beaver & Degen 2018](#). Testing the occasion verbs twice, that is, in both Experiment 1 and 2, allowed us to show that the obtained results are replicable, an important desideratum in experimental research. Moreover, this also enabled a comparison of occasion verbs with a greater number of well-established triggers (due to a relatively large number of trials in each experiment).

Experiment 3 combined design ideas from the studies by Mandelkern et al. (2020) and Tonhauser, Beaver & Degen (2018) in testing the left-right (a)symmetric filtering potential of occasion verbs as compared to more well-established triggers like factive and aspectual verbs.

2 Experiment 1: Projectivity, at-issueness and contextual constraints

The first experiment investigated the projectivity and cataphoric resolution of the occasion implication, comparing occasion verbs to a number of expressions commonly assumed to be associated with projective contents. With regard to projectivity, we adopted the methods and diagnostics from Tonhauser, Beaver & Degen 2018 to establish whether occasion verbs pattern with the more established triggers in terms of projectivity and at-issueness. With respect to cataphoric resolvability, we employed a paradigm manipulating the presence and order of the projective content relative to the trigger. This paradigm allowed us to investigate whether occasion verbs impose a strong contextual felicity constraint (Tonhauser et al. 2013) and to what extent the projective content can be resolved cataphorically, that is, occur to the right of the associated trigger.

As to projectivity and at-issueness, Experiment 1 tested the following hypotheses derived from the above theoretical considerations:

- Occasion verbs pattern with established triggers of projective content regarding their projectivity. (H1)
- Occasion verbs display a correlation between (not-)at-issueness and projectivity comparable to other triggers of projective content. (H2)

In relation to cataphoric resolvability and the property of strong contextual felicity as an important prerequisite thereof, the following hypotheses were tested:

- Occasion verbs impose a strong contextual felicity constraint on their context, that is, they are rated significantly better in *m*-anaphoric contexts (when the projective content is entailed by the preceding context) than in *m*-neutral contexts (when the projective content is not entailed by the context). (H3)
- Utterances involving an occasion implication are judged as equally acceptable in *m*-cataphoric contexts (where the projective content occurs to the right of the trigger) as in *m*-anaphoric contexts. (H4)

The comparison with other triggers in this and the next experiment allows us to address whether this sets occasion verbs apart from other triggers. We hypothesized that occasion verbs should come out as rather special, or even unique, concerning cataphoric resolvability:

- Cataphoric resolution is only found for projective content associated with occasion verbs (relative to triggers from previous research imposing a strong contextual felicity constraint). (H5)

2.1 Design

Anaphoricity/cataphoricity and projectivity/at-issueness were investigated in two consecutive blocks. Block 1 employed a single factor CONTEXT TYPE (*m-neutral* vs. *m-anaphoric* vs. *m-cataphoric*) testing for strong contextual felicity and anaphoricity vs. cataphoricity. Block 2 also employed a single factor design investigating projectivity and at-issueness as gradable properties.

2.2 Methods

2.2.1 Participants

Participants were recruited via the crowdsourcing platform Prolific for a payment of 4.50 GBP (N=59 students with German as their native language) or took part for course credit at Bielefeld University (N=15). Three students from Bielefeld were excluded because they reported German not to be their native language. The 71 participants remaining in the study (37 male; 34 female) had a mean age of 23.7 years (range 18–34 years). They typically completed the experiment in less than 15 minutes (median: 13.5 minutes). Participants were randomly assigned to the six versions of the experiment, aiming at a maximally even distribution across lists (with either 11 or 12 participants per list).

2.2.2 Materials

The following sixteen German occasion verbs, among them various judgment verbs (Au 1986, Ferstl, Garnham & Manouilidou 2011, Fillmore 1969, McCawley 1975, Rudolph & Försterling 1997, Solstad & Bott 2023), were included in the study: *anzeigen* ‘report someone for something’, *auszeichnen*

'honour', *bestrafen* 'punish', *belohnen* 'reward', *belangen* 'prosecute'/'sue', *danken* 'thank', *ehren* 'honour', *entlassen* 'fire', *gratulieren* 'congratulate', *kritisieren* 'criticize', *loben* 'praise', *sich rächen an* 'take revenge on', *sich revanchieren bei* 'return the favour', *verklagen* 'sue', *zur Verantwortung ziehen* 'hold accountable', and *zurechtweisen* 'reprimand'. They were chosen because they exhibit a strong Implicit Causality object bias with an average of 86.5% object coreference (range 63%–100%) in discourse continuation experiments as discussed in the Introduction (Bott & Solstad 2014, 2021).

For Block 1 investigating strong contextual felicity and cataphoricity/anaphoricity, participants should judge the coherence of mini-discourses. To this end, simple German target sentences of the form *he occasion verb-ed her* (items 1–8) and *she occasion verb-ed him* (items 9–16) were constructed. These were embedded in larger discourse contexts as illustrated for the occasion verb *thank* below (the target sentence is underlined):⁵

(21) **Introductory context:**

Susanne und Franz gehen auf dieselbe Schule.

'Susanne and Franz attend the same school.'

a. **neutral:**

Sie dankte ihm.

'She thanked him.'

b. **anaphoric:**

Er hatte sie in der Matheklausur abschreiben lassen. Sie dankte ihm.

'He had let her write off the math exam. She thanked him.'

c. **cataphoric:**

Sie dankte ihm. *Er hatte sie in der Matheklausur abschreiben lassen.*

'She thanked him. He had let her write off the math exam.'

For the *neutral* condition (21a), the target sentence containing the occasion verb was simply preceded by an introductory sentence introducing the two referents without giving any information about the occasioning eventuality. In the *anaphoric* condition (21b), a sentence providing a plausible reason for the agent to act was provided in a sentence intervening between the introductory context and the target sentence. This intervening sentence was given in the pluperfect tense and contained pronouns, too, referring back to

⁵ In the following, conditions involving *m*-neutral/anaphoric/cataphoric contexts are mostly referred to simply as neutral, anaphoric, and cataphoric.

the two referents. Finally, in the *cataphoric* condition (21c), the sentence providing the reason followed the target sentence. Recall that this is the typical way of providing explanations for occasion verbs in sentence continuation studies as employed for Implicit Causality verbs (Bott & Solstad 2014, 2021, Solstad & Bott 2023). For better comparability between occasion verb items and other items, we refrained from stating explicitly that the potential reason also actually constituted a reason (e.g., by means of a causal connective).

A Latin Square design was used to distribute the experimental items to three lists such that each item appeared only in one condition in each list and that each list contained each condition at least five times. In sum, Block 1 consisted of 37 trials in each list — 16 occasion verb items and 21 filler trials (three trials for each of the seven additional triggers, see below).

In Block 2, investigating projectivity and at-issueness, participants provided gradable ‘yes’-‘no’ answers to questions targeting these properties (as in Tonhauser, Beaver & Degen 2018). The target sentence (e.g., *She thanked him*) was turned into a question including the same proper names as in Block 1, and this question was embedded as a direct quote under a question predicate as in (22), without explicitly mentioning a possible reason:

(22) **Dialogue snippet:**

Phillipp fragt: “Hat Susanne Franz gedankt?”

‘Phillipp asks, “Did Susanne thank Franz?”’

Projectivity and at-issueness were measured with “certain-that” and “asking-whether” questions, respectively (Tonhauser, Beaver & Degen 2018). For the sample item, projectivity was queried by posing the following question regarding the speaker’s commitment to the projective content. Note that the question makes explicit reference to an occasion *for the agent* (see the discussion in the Introduction):

(23) **Projectivity question:**

Ist sich Phillipp sicher, dass es einen Anlass für Susanne gab, Franz zu danken?

‘Is Phillipp certain that there was an occasion for Susanne to thank Franz?’

Testing whether the content projects from the polar question, this question should be answered positively for projective content, that is by moving the slider from the initial position in the middle towards ‘yes’. Since no potential reason for the action described by the occasion verb was given in the dia-

logue snippet, we used the noun *Anlass* ‘occasion’ to tap into the (implicit) projective content (23). As this noun has a meaning that can be circumscribed as “(external) reason”/“occasion”, it was deemed suitable to ask for the projective content as specified in (5).

At-issueness was queried by asking questions as in (24). According to the Gradient Projection Principle (Tonhauser, Beaver & Degen 2018), such questions should trigger more negative responses for utterances involving projective contents, thus patterning on the *not*-at-issue side.

(24) **At-issueness question:**

Fragt Phillipp, ob es einen Anlass für Susanne gab, Franz zu danken?
 ‘Is Phillipp asking whether there was an occasion for Susanne to thank Franz?’

Each item was constructed with the two kinds of follow-up questions, and these two question conditions were distributed to two lists such that each list contained each item in only one condition and also such that both lists contained eight projectivity and eight at-issueness questions. In addition, ten filler items were added to both lists. Five involved projectivity ratings about asserted content and another five involved at-issue ratings about at-issue content. In total, Block 2 contained 30 trials in each of the two lists — 16 occasion verb items and 14 filler items (2 trials for each of the seven additional triggers).

As already indicated, seven additional types of triggers of projective content were also included in the experiment. These triggers included personal pronouns and demonstrative NPs, which have been classified as triggers that impose a strong contextual felicity constraint (Tonhauser et al. 2013). Further triggers that were assumed not to involve a strong contextual felicity constraint were the factive verbs *wissen* ‘know’ and *entdecken* ‘discover’, the aspectual verb *aufhören* ‘stop’, possessive NPs such as *sein Motorrad* ‘his motorcycle’, and, finally, non-restrictive relative clauses (NRRCs) modifying a proper name. For each of these triggers, three items were generated in three conditions for Block 1, of which the first two were modified to be tested again in Block 2. A Latin Square design was used to distribute the experimental items to three lists in Block 1 and to two lists in Block 2, making sure that each trigger was tested once in each condition in each list.

The materials of the two blocks were combined in such a way that there were six versions of the experiment including all possible combinations of lists. All original experimental materials with English translations for this

and the other experiments are available in the Supplementary materials and in the OSF repository accompanying this paper.⁶

2.2.3 Procedure

The experiment was conducted on a web server at the University of Tübingen employing the freely available OnExp software.⁷ Participants received a link to one of the six experiment versions. They were instructed that their task in Block 1 was to rate texts for discourse coherence/acceptability (*Wie akzeptabel ist dieser Text?* ‘How acceptable is this text?’), whereas they should answer questions about single moves as part of longer conversations in Block 2. We used the same instructions as [Tonhauser, Beaver & Degen 2018](#): *Imagine you’re at a party and step into an ongoing conversation in the kitchen*. After entering relevant personal data (native language(s), age, gender) and giving written consent, participants were presented Blocks 1 and 2 consecutively with trials individually randomized within each block. At the end of Block 2 participants were provided with a link to Prolific where they could sign up for their reward. The experiment contained no attention checks.

Each trial consisted of a text or dialogue in the center of the screen. Under the text/dialogue there was a slider initially positioned in the middle of the scale. The ends of the scale were labeled differently in the two blocks: In Block 1 (discourse acceptability), the labels were *completely acceptable* and *completely unacceptable*, whereas the labels in Block 2 (projectivity/at-issueness) were *yes* and *no*. After participants had adjusted the slider to the position they felt to be appropriate, they had to click a button to receive the next trial. The final position of the slider was internally mapped to values between 1 and 100, with “no” coded as 1 and “yes” as 100.

2.2.4 Data analysis

We used R ([R Core Team 2022](#)) and the package *lme4* ([Bates et al. 2015](#)) to perform linear mixed effects analyses of the contextual felicity of the triggers under investigation ([Baayen, Davidson & Bates 2008](#)). Models always included the maximal random-effects structure justified by the design ([Barr et al. 2013](#)) and convergence. The random effects structure in this and the following experiments included crossed random effects of participants and of items, with

⁶ <https://osf.io/76rxb/>.

⁷ <https://onexp.textstrukturen.uni-goettingen.de/>

items being the particular combinations of specific triggers (e.g., an occasion verb) within some trigger type and the individual lexical tokens testing this particular trigger.⁸ Visual inspection of residual plots did not reveal any obvious deviations from normality. The likelihood of parameter estimates was approximated by using standard Maximum Likelihood estimation (instead of REML; Bolker et al. 2008). Parameter estimates are always reported from the maximal model. Significance testing of fixed effects was done by likelihood ratio tests of the full model with the effect in question against the model without the effect in question. All analyses and data for this and the other experiments are available in the Supplemental Materials and the OSF repository accompanying this paper (see Footnote 6). Model equations including random effects structures computed for all experiments are also provided in the Supplemental Materials.

2.3 Results and discussion

We start off with the results from Block 2, investigating projectivity and at-issueness before turning to Block 1 which tested for cataphoric resolvability and strong contextual felicity. For ease of comparison with the values reported in Tonhauser, Beaver & Degen 2018 and Bott & Solstad 2022, all ratings were transformed to values between 0 and 1. As for projectivity and at-issueness, *yes* vs. *no* ratings were transformed in such a way that a value of 1 corresponds to the maximal possible value for projectivity and at-issueness, whereas a value of 0 corresponds to the minimal possible value.

2.3.1 Projectivity and at-issueness (Block 2)

The plot in Figure 1 shows the mean projectivity and at-issueness ratings of occasion verbs relative to the other seven triggers, whereas Figure 2 displays the mean projectivity and at-issueness ratings for the individual occasion verbs. Similarly to Tonhauser, Beaver & Degen 2018, we observed a negative correlation between projectivity and at-issueness for the eight trigger types which was marginally significant (ratings aggregated over trigger types, Pearson $r = -0.70$; $t(6) = -2.37$, $p = .06$): The less at-issue a given content was rated, the higher its projectivity ratings turned out to be.

⁸ We are thus abstracting away from the nested structure realized for occasions verbs which set them apart from the other triggers that only involved two (Block 2) or three (Block 1) trigger instances.

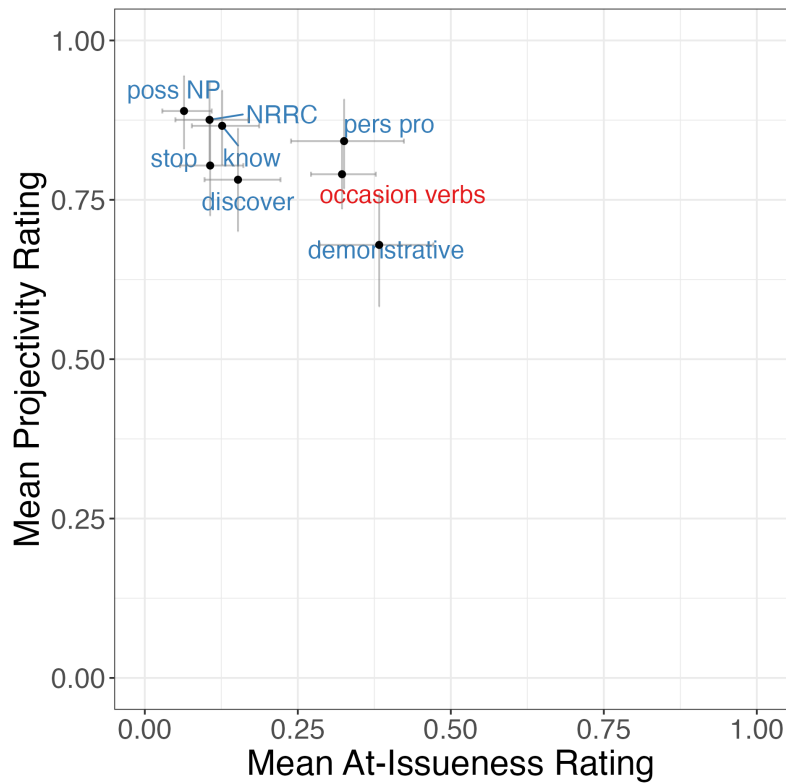


Figure 1: Mean projectivity and at-issuiness ratings of occasion verbs relative to the mean ratings for the other seven types of triggers in Block 2 of Experiment 1. Error bars indicate bootstrapped 95% confidence intervals of projectivity (vertical dimension) and at-issuiness ratings (horizontal dimension). Abbreviations: NRRC = Non-restrictive relative clause.

The occasion verbs patterned well with the other, well-established triggers. The occasion implication triggered by these verbs clearly projected with a projectivity rating of 0.79 on average with values ranging between 0.73 and 0.87 for individual verbs. The projective contents also turned out to be not-at-issue with a mean at-issuiness rating of 0.32 with a range between 0.17 and 0.57 for individual verbs. These two findings show that the external reasons observed for these verbs in Implicit Causality studies are clear instances of projective content. A point worth mentioning is that the correlation between projectivity and at-issuiness observed for data aggregated over trigger types broke down once we looked into the degree of projectivity and at-issuiness of the individual occasion verbs included in the study ($r = 0.05$;

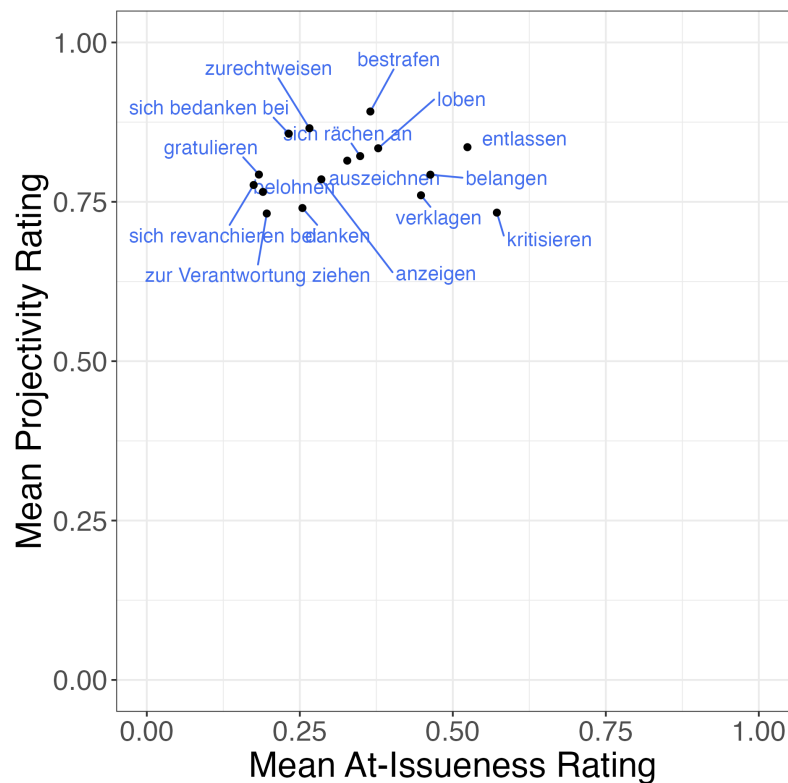


Figure 2: Mean projectivity and at-issueness ratings for the individual occasion verbs in Block 2 of Experiment 1. Error bars indicate bootstrapped 95% confidence intervals of projectivity (vertical dimension) and at-issueness ratings (horizontal dimension).

$t(14) = .18, p = .86$). However, given the limited amount of data for the individual verbs with only one lexicalization/item per verb, more research is needed to assess whether the proposed inter-dependency between projectivity and at-issueness applies also to individual verbs (for by-item effects of at-issueness on projectivity, see [Tonhauser, Beaver & Degen 2018](#)).

2.3.2 Anaphoricity and cataphoricity (Block 1)

Another central aim of Experiment 1 was to compare the anaphoric and cataphoric resolution of the triggers. We had hypothesized occasion verbs to differ from other triggers in allowing for cataphoric resolution. Such resolution can only be meaningfully discussed for triggers that require that their

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projective content be entailed by the context. These triggers should display a reduced acceptability in *m*-neutral contexts. A side issue is the question of accommodation possibilities (Lewis 1979, Beaver & Zeevat 2007, von Fin-tel 2008, Tonhauser et al. 2013, Roberts 2015). Triggers of projective content easily allowing for accommodation should be as acceptable in the neutral as in the anaphoric condition or even rated better in the former condition.

The average ratings across triggers and contexts are shown in Figure 3. Only three trigger types imposed a strong contextual felicity constraint in the sense that they received higher ratings in the anaphoric condition than in the neutral condition. These were occasion verbs, personal pronouns, and demonstrative NPs. The results for the latter two trigger types fit well with

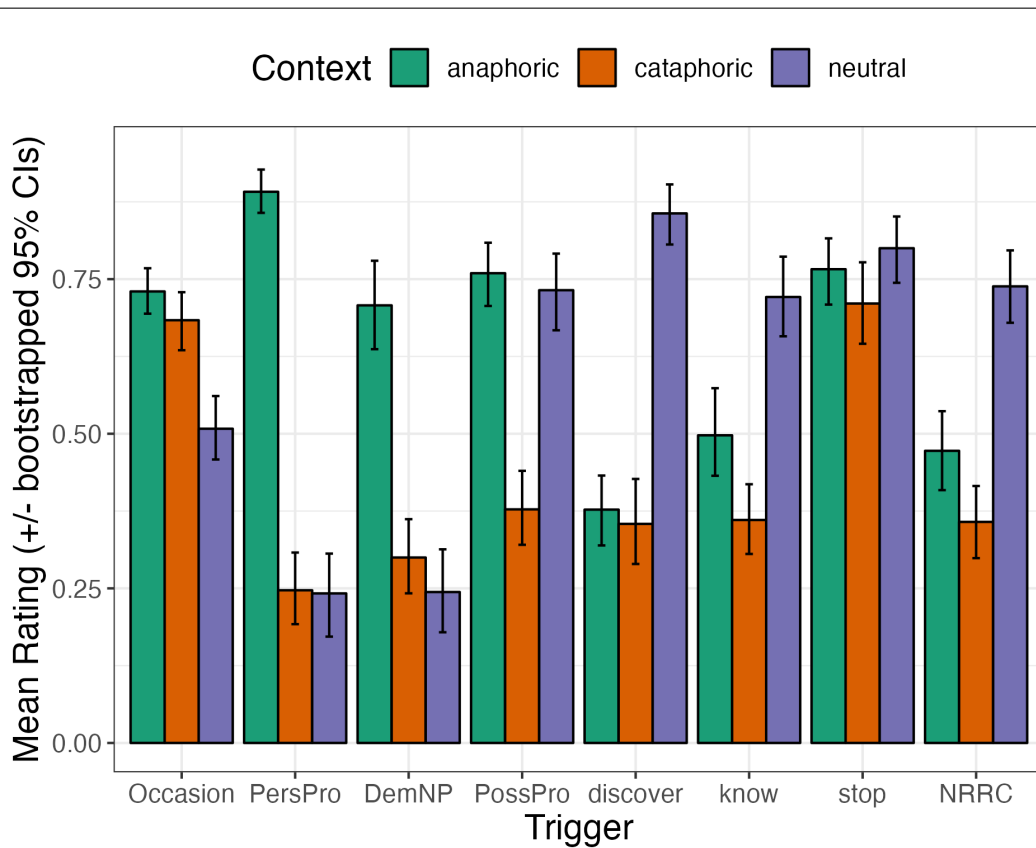


Figure 3: Mean ratings in Block 1 of Experiment 1 for the different trigger types with target sentences embedded in (*m*-)neutral, anaphoric and cataphoric discourse contexts. Error bars indicate bootstrapped 95% confidence intervals of condition means.

the findings in [Tonhauser et al. 2013](#) for Guaraní and English. For the other triggers, the neutral condition was either (i) rated as high as the anaphoric condition in the case of the possessor implication of possessive pronouns and the prestate implication of *stop*—or they were (ii) rated even better than the anaphoric condition in the case of the projective content of non-restrictive relative clauses and the factive verbs *know* and *discover*—also in line with the claims in [Tonhauser et al. 2013](#). While the possessor implication and the projective content of *stop* can easily be accommodated, non-restrictive relative clauses, *know* and *discover* even display a reduced discourse coherence in the anaphoric condition, most likely due to a perceived redundancy. This redundancy may be related to the fact that these triggers allow for the introduction of novel information (see the notion of *informative presuppositions* [Karttunen 1974](#), [Spenader 2003](#), [Tonhauser et al. 2013](#)).

Turning to occasion verbs, we found clear indication that the occasion implication requires contextual support. The statistical analysis revealed that the anaphoric condition was clearly preferred over the neutral condition ($\beta = 22.37$, $se = 2.84$, $\chi^2(1) = 29.08$, $p < .001$). Also, the cataphoric condition was rated significantly better than the neutral condition ($\beta = 17.93$, $se = 2.41$, $\chi^2(1) = 36.72$, $p < .001$). These verbs thus impose a contextual felicity constraint on their context. However, the supportive context is not limited to an anaphoric dependency to the preceding context, but may also be introduced after the target sentence containing the trigger. Put differently, they are not only *m*-positive ([Tonhauser, Beaver & Degen 2018](#)), but may be either *m*-anaphoric or *m*-cataphoric.

Interestingly, occasion verbs differed from the two other triggers involving a strong contextual felicity constraint with respect to both cataphoric resolution and anaphoric resolution. The parameters from the global linear mixed-effects model analysis are summarized in [Table 1](#). Even though all three triggers imposed a strong contextual felicity constraint in the narrower sense of [Tonhauser et al. 2013](#), the difference between the anaphoric and the neutral conditions were not of the same size. This was reflected by significant interaction terms for the contrasts NEUTRAL VS. ANAPHORIC and TRIGGER OCCASION VERB VS. PRONOUN ($\chi^2(1) = 26.33$, $p < .001$) as well as for the interaction between NEUTRAL VS. ANAPHORIC and TRIGGER OCCASION VERB VS. DEM(ONSTRATIVE) NP ($\chi^2(1) = 12.61$, $p < .001$). These interactions were due to the fact that the difference in relative acceptability between the neutral and the anaphoric condition was smaller for occasion verbs than it was for pronouns and demonstrative NPs. Closer inspection shows that the

	<i>estimate</i>	<i>SME</i>	<i>t-value</i>
INTERCEPT	50.81	2.71	18.73
CONTEXT NEUTRAL VS. ANAPHORIC	22.37	2.72	8.23
CONTEXT NEUTRAL VS. CATAPHORIC	17.95	2.14	8.38
TRIGGER OCCASION VS. PRONOUN	-26.54	4.32	-6.14
TRIGGER OCCASION VS. DEM. NP	-26.30	4.32	-6.08
NEUTR/ANA × OCCASION/PRON	42.27	5.15	8.21
NEUTR/ANA × OCCASION/DEM	24.06	5.15	4.67
NEUTR/CATA × OCCASION/PRON	-17.36	4.15	-4.18
NEUTR/CATA × OCCASION/DEM	-12.72	4.17	-3.05

Table 1: Parameter estimates for categorical fixed effects (scaled to the interval [0, 100]) in the global linear mixed-effects regression analysis of Experiment 1. Contrasts involved neutral contexts and occasion verbs, respectively, as reference levels for treatment coding. The intercept thus corresponds to the mean rating observed for the neutral condition of occasion verbs.

neutral condition was very low in acceptability for the latter two trigger types, but that the projective contents of occasion verbs were somewhat easier to accommodate.



For the two contrasts testing the availability of cataphoric resolution, two reliable interactions were also observed (OCCASION/PRONOUN × NEUTRAL/CATAPHORIC: $\chi^2(1) = 15.01$, $p < .001$; OCCASION/DEM. NP × NEUTRAL/CATAPHORIC: $\chi^2(1) = 7.87$, $p < .01$). These interactions were due to the fact that cataphoric resolution was only an option for occasion verbs, but not the other two trigger types. This was further corroborated by follow-up analyses breaking down these interactions. We computed one linear mixed-effects regression analysis on a subset of the data comparing the neutral vs. the cataphoric condition for pronouns ($\chi^2(1) = .03$, $p = .87$) and a second one for demonstrative NPs ($\chi^2(1) = 1.92$, $p = .17$). The lack of effects in both follow-up analyses suggests that cataphoric resolution of projective content is not an option for these two trigger types.

Summing up the results of Experiment 1, we showed that the occasion implication associated with occasion verbs is in fact projective in nature. This new trigger type patterned with other, well-established triggers of projective content with respect to projectivity and at-issueness and their negative correlation. At the same time, occasion verbs proved to introduce a special

kind of projective content, since they were the only triggers that allowed for cataphoric resolution of this content.

3 Experiment 2: Replication and extension

Experiment 2 applied the same methods as Experiment 1 and served a two-fold goal: First of all, we wanted to replicate and extend the results from Experiment 1. In doing so, we compared occasion verbs to more triggers often discussed in previous research on projective content (and not included in Experiment 1, which was already quite lengthy with around 100 trials). Second, we investigated whether the properties identified in Experiment 1 for occasion verbs are as exceptional as we claimed or whether they would also be present in two other classes of Implicit Causality verbs not assumed to be projective by Bott & Solstad (2014, 2021) and Solstad & Bott (2022): subject-biased stimulus-experiencer verbs and object-biased experiencer-stimulus verbs:

- (25) a. **stimulus-experiencer:**
Peter annoyed Mary because ...  **he** was very noisy.
- b. **experiencer-stimulus:**
Peter admired **Mary** because ...  **she** was very clever.

Previous research has shown strong mirror-like coreference biases for these two classes of psychological verbs, with a bias towards the stimulus argument in explanations (Brown & Fish 1983, Ferstl, Garnham & Manouilidou 2011, Hartshorne, O'Donnell & Tenenbaum 2015, Solstad & Bott 2022). As outlined in the Introduction for *annoy*, we expected any inferences triggered by this type of verb not to be projective in the sense of occasion verbs. Put differently, we expected their explanatory content to be more at-issue and less projective than those triggered by occasion verbs. At the same time, we expected stimulus-experiencer and experiencer-stimulus verbs to allow for explication of the content in question both in the preceding and in subsequent context, since they also predominantly trigger explanations in full stop prompts, see (3). In sum, the present experiment once again addressed the questions whether occasion verbs are similar to other well-established triggers in term of projectivity and at-issueness (Hypotheses H1 and H2 from above), whether they require resolution in context (H3), but at the same time differ from other triggers with regard to the availability of cataphoric resolution (H4, H5), broadening the picture by testing further triggers. In addition, the experiment addressed the question whether these properties are special

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for occasion verbs or whether they are shared by all Implicit Causality verbs, as formulated in Hypotheses H6 and H7:

- All Implicit Causality verbs call for either a cataphoric or an anaphoric specification of an implicit cause. (H6)
- Occasion verbs are the only Implicit Causality verbs to pattern with other triggers of projective content in terms of projectivity and at-issueness. (H7)

3.1 Methods

3.1.1 Participants

60 native German participants (mean age 23.7 years, range 18–35 years; 15 female, 45 male) were recruited via Prolific, using screeners to invite only students who had not participated in Experiment 1. Every participant received 2.70 GBP. The payment was lower than in Experiment 1 because we had overestimated the time needed to complete that experiment. Participants typically completed Experiment 2 within less than 20 minutes (median: 17 minutes). All participants were included in the analysis.

3.1.2 Materials

The occasion verb items were taken from Experiment 1 (Section 2). They were identical except for three minor stylistic changes with respect to tense (context sentences which contained a temporal adverb were changed from pluperfect to the less marked simple past tense). Six other triggers of projective content were included in the experiment: *auch/ebenfalls* ‘too’, *wieder* ‘again’, *schaffen* ‘manage’, definite descriptions, clefts, and appositives. Based on the classification in [Tonhauser et al. 2013](#), we expected only the existence of an alternative implication of *auch* ‘too’ to impose a strong contextual felicity constraint. As before, Block 1 tested anaphoric and cataphoric resolution, whereas the properties of projectivity and at-issueness were investigated in Block 2.

The study also included nine experiencer-stimulus and nine stimulus-experiencer verbs. The experiencer-stimulus verbs were *anhimmeln* ‘idolize’, *bedauern* ‘regret’, *bemitleiden* ‘pity’, *fürchten* ‘fear’, *lieben* ‘love’, *schätzen* ‘appreciate’, *verabscheuen* ‘abhor’, *verachten* ‘despise’, and *verehhren* ‘adore’, with very strong Implicit Causality object biases well above 90% in sentence

completion tasks (Solstad & Bott 2022). The stimulus-experiencer verbs display an equally strong subject bias: *ängstigen* ‘frighten’, *beeindrucken* ‘impress’, *bezaubern* ‘charm’, *enttäuschen* ‘disappoint’, *faszinieren* ‘fascinate’, *inspirieren* ‘inspire’, *schockieren* ‘shock’, *verblüffen* ‘baffle’, and *verwirren* ‘confuse’. For these verbs, we tested the implication of a relevant property of the stimulus argument, see (25). Sample item (26) illustrates the conditions tested in Block 1 investigating anaphoric/cataphoric resolution and strong contextual felicity.

(26) **Introductory context:**

Amelie und Daniel kennen sich seit Jahren.

‘Amelie and Daniel have known each other for years.’

a. **neutral:**

Sie schockierte ihn zutiefst.

‘She shocked him deeply.’

b. **anaphoric:**

In der letzten Zeit hatte sie plötzlich angefangen, Verschwörungstheorien zu verbreiten. Sie schockierte ihn zutiefst.

‘Lately, she had suddenly started spreading conspiracy theories.

She shocked him deeply.’

c. **cataphoric:**

Amelie und Daniel kennen sich seit Jahren. Sie schockierte ihn zutiefst. In der letzten Zeit hatte sie plötzlich angefangen, Verschwörungstheorien zu verbreiten.

‘Amelie and Daniel had known each other for years. She shocked him deeply. Lately, she had suddenly started spreading conspiracy theories.’

(27) exemplifies the case-disambiguated items querying projectivity and at-issueness ratings in Block 2:

(27) **Dialogue snippet:**

Wolfgang fragt: “Schockierte die Amelie den Daniel?”

‘Wolfgang asks: “Did Amelie shock Daniel?”’

(27) **Projectivity question:**

Ist sich Wolfgang sicher, dass Amelie etwas getan hat, das Daniel schockierend finden könnte?

‘Is Wolfgang certain that Amelie has done something that Daniel might find shocking?’

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(27) **At-issueness question:**

Fragt Wolfgang, ob Amelie etwas getan hat, das Daniel schockierend finden könnte?

'Is Wolfgang asking whether Amelie has done something that Daniel might find shocking?'

A total of 52 items (16 occasion, 18 psychological verb items + 6×3 other triggers) in Block 1 were distributed over three lists. In combination with the two lists containing the 46 items of Block 2 (16 occasion, 18 psychological verb items + 6×2 other triggers), six versions of the experiment were constructed with a total of 98 trials each.

3.1.3 Procedure

The procedure was identical to the one in Experiment 1. The order of trials within each block was individually randomized for each participant. Each of the six versions of the experiment was administered to ten participants via Prolific.

3.2 Results and discussion

Ratings were transformed to values between 0 and 1 as in Experiment 1. Due to copy-and-paste errors affecting two items in Block 2, *loben* 'praise' and *gratulieren* 'congratulate' were excluded from analysis of projectivity and at-issueness. Thus, only 14 of the 16 occasion verbs remained in the analysis reported below.

3.2.1 Projectivity and at-issueness (Block 2)

The plot in Figure 4 shows the mean projectivity and at-issueness ratings of occasion verbs relative to all other triggers tested in this and the previous experiment in addition to the two other classes of Implicit Causality verbs (stimulus-experiencer and experiencer-stimulus verbs). In Experiment 2, occasion verbs received a mean projectivity rating of 0.69 and a mean at-issueness rating of 0.35. Even though the projectivity ratings were somewhat lower than in Experiment 1, the ratings suggest that the occasion implication still projects to a relatively high degree and is likewise rated relatively low with respect to not-at-issueness. Again, occasion verbs patterned with instances of well-established triggers of projective content. As in Experiment 1,

we analyzed whether we find evidence for the correlation between a trigger's projectivity and its at-issueness. In Experiment 2, a strong negative correlation was observed (Pearson's $r = -0.90$, $t(7) = -5.33$, $p < .01$).

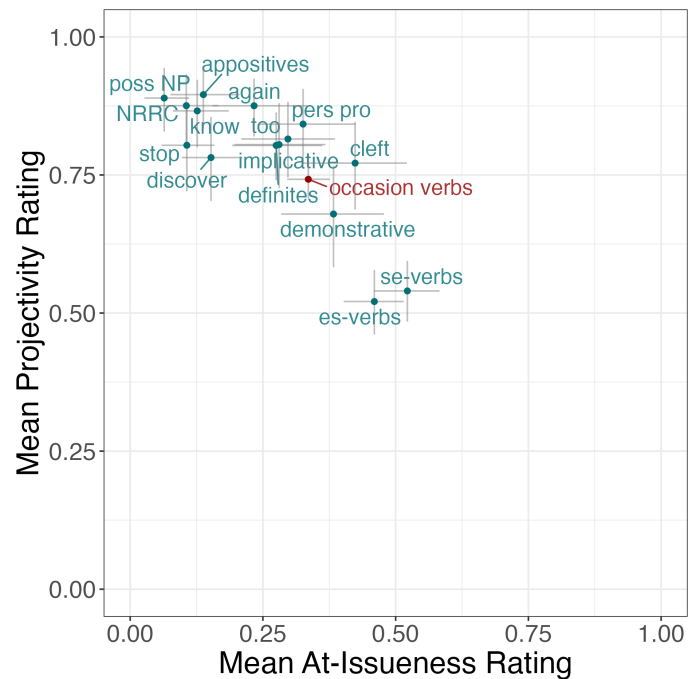


Figure 4: Mean projectivity and at-issueness ratings of occasion verbs, other types of projective contents and the two Implicit Causality bias psychological verb classes, stimulus-experiencer/se-verbs and experiencer-stimulus/es-verbs, tested in Experiments 1 and 2. Error bars indicate bootstrapped 95% confidence intervals of projectivity (vertical dimension) and at-issueness ratings (horizontal dimension).

Interestingly, all projective contents were set apart from the implications triggered by psychological verbs. Both experiencer-stimulus and stimulus-experiencer verbs received mean projectivity ratings (experiencer-stimulus: 0.52; stimulus-experiencer: 0.54) and at-issueness ratings (experiencer-stimulus: 0.46; stimulus-experiencer: 0.52) well within the mid range of the scale.

To see whether this difference is warranted by the data, a k -means clustering analysis was performed including all ‘trigger’ types from Experiment 1 and 2 with respect to their projectivity and at-issueness values. The optimal number of clusters $k = 3$ was determined using the elbow method (see the output of the RMD script in the Supplemental Materials and the OSF archive, cf. footnote no. 6). The resulting three clusters are shown in Figure 5. While

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the psychological verbs form a cluster of their own, other triggers formed two additional clusters. Contrary to psychological verbs, the analysis categorized occasion verbs together with clearly projective contents such as definite descriptions, implicative verbs, clefts, *too*, personal pronouns and demonstrative NPs.

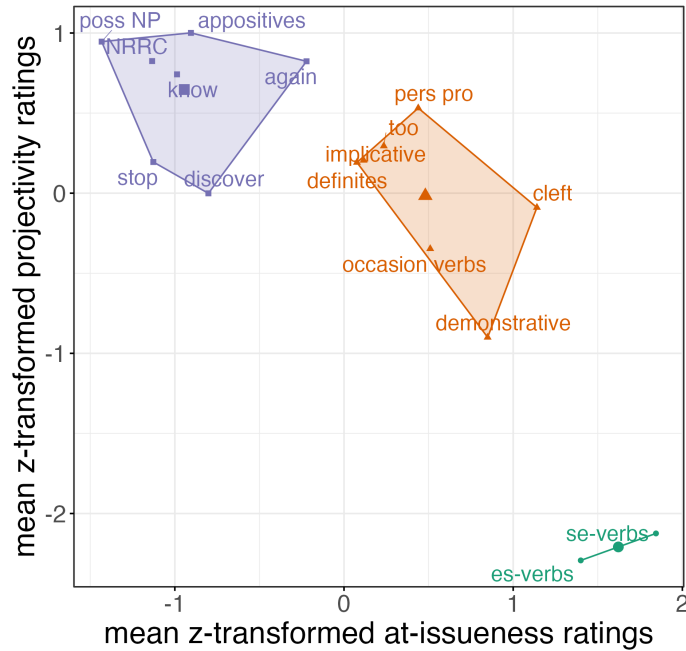


Figure 5: Results of k-means clustering with $k = 3$ clusters including all types of expressions from Experiments 1 and 2. Optimal number of clusters determined by the elbow method.

The distribution of the individual occasion and psychological verbs in these clusters is shown in Figure 6. With just one exception — *lieben* ‘love’, for which the property of the stimulus is more not-at-issue than for other verbs, — all psychological verbs clearly patterned outside the cluster of the occasion verbs. Thus, the individual verbs showed the same distribution with respect to the projectivity/at-issueness space as did the verb classes on a more global level.

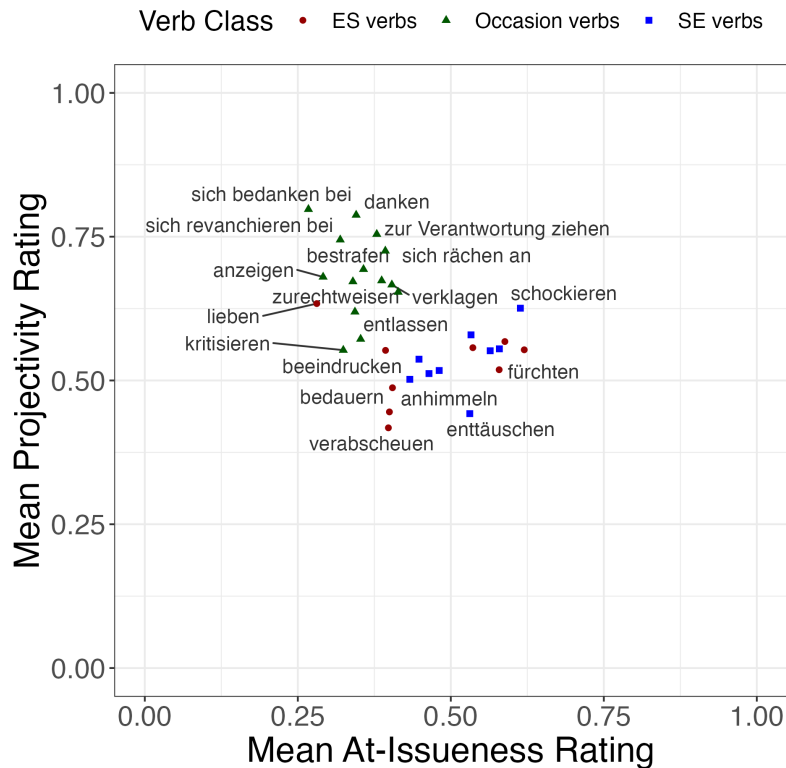


Figure 6: Mean projectivity and at-issueness ratings of individual verbs tested in Experiment 2. Not all points are labeled due to substantial visual overlap.

3.2.2 Anaphoricity and cataphoricity (Block 1)

The mean ratings for the three context types in Block 1 are shown in Figure 7. As in Experiment 1, occasion verbs showed clear contrasts between the neutral and the two contextually licensed conditions. The neutral condition received a mean rating of 0.49, whereas the anaphoric and the cataphoric conditions received mean ratings of 0.69 and 0.68, respectively. The linear mixed-model regression analysis revealed that both the contrast between the neutral and the anaphoric condition ($\chi^2(1) = 24.65, p < .001$) as well as the contrast between the neutral and the cataphoric condition ($\chi^2(1) = 31.62, p < .001$) were significant. Next, we analyzed whether this context dependency set the occasion verbs apart from the only other trigger in the present experiment imposing a strong contextual felicity constraint,

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the additive particle *auch* ‘too’. The analysis revealed that with respect to the first contrast, the comparison between the *neutral* and the *anaphoric* context conditions, occasion verbs and *auch* showed similarly sized differences that were marginally larger for *auch* than for occasion verbs (interaction TRIGGER \times NEUTRAL/ANAPHORIC: $\chi^2(3) = 7.14, p = .07$). With respect to cataphoric resolvability, however, the two trigger types showed a clear difference (interaction TRIGGER \times NEUTRAL/CATAPHORIC: $\chi^2(1) = 9.95, p < .01$). In contrast to occasion verbs, *auch* does not allow for cataphoric resolution. This was corroborated by a follow-up analysis breaking down the interaction in a subset analysis only comparing the NEUTRAL and the CATAPHORIC condition for *auch* ($\chi^2(1) = 1.15, p = .28$).

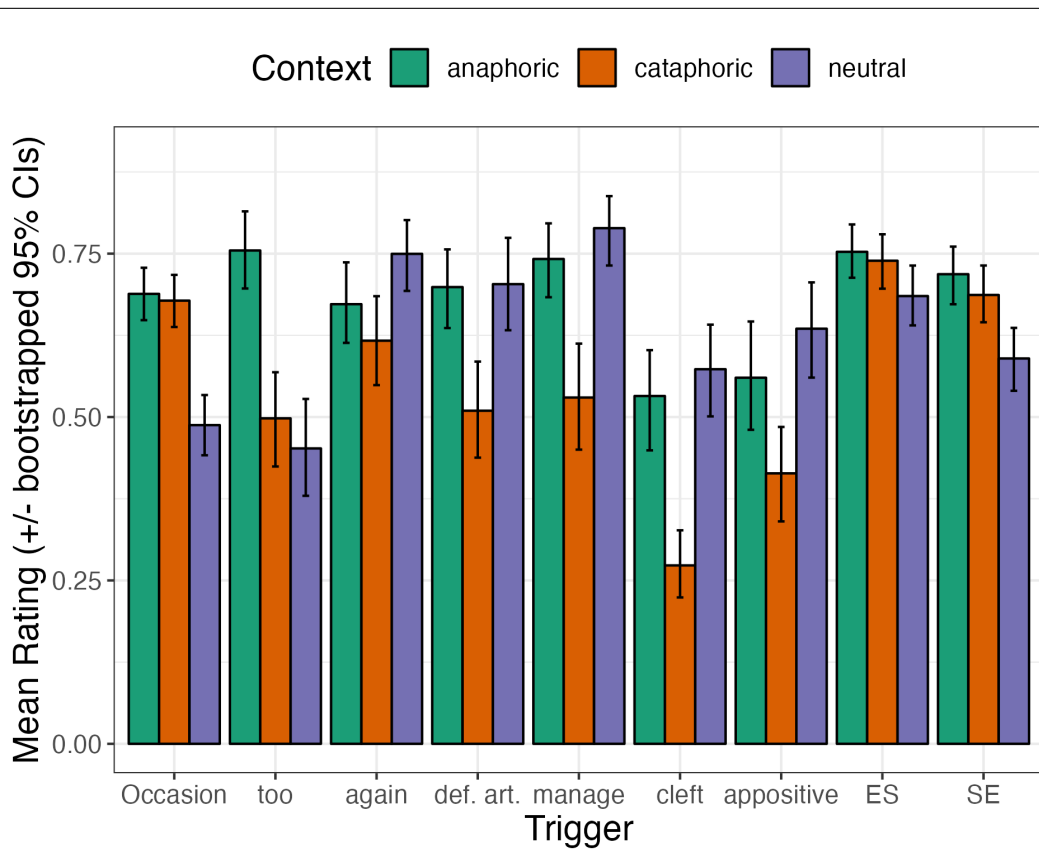


Figure 7: Mean ratings in Block 1 of Experiment 2 for the different trigger types with target sentences embedded in neutral, anaphoric and cataphoric (relative to projective meaning *m*) discourse contexts. Abbreviations: def. art. = definite article, ES = experiencer-stimulus, SE = stimulus-experiencer

The other five triggers included in the stimulus set cannot be taken to impose a strong contextual felicity constraint on their context, since the neutral condition was rated at least as good as the anaphoric condition.

In a final mixed-effects regression analysis, we analyzed the contextual constraints of occasion verbs relative to the two types of psychological verbs. The analysis included (1) the contrast between occasion verbs and experiencer-stimulus (ES) verbs, and (2) the contrast between occasion verbs and stimulus-experiencer (SE) verbs. The results of the global analysis are summarized in Table 2. The analysis showed significant interactions between OCCASION/ES and both contextual contrasts ($\chi^2(2) = 27.33, p < .001$) as well as between OCCASION/SE and the two contextual contrasts ($\chi^2(2) = 10.74, p < .01$). These interactions were due to the fact that both psychological verb classes were more acceptable than the occasion verbs when presented in the neutral context conditions relative to the anaphoric and the cataphoric contexts. In line with the differences already observed with respect to projectivity and at-issueness, the psychological verbs did not require the explicit mention of their implicitly triggered implications, whereas the external reasons of occasion verbs cannot be left implicit without discourse coherence being reduced.

	<i>estimate</i>	<i>SME</i>	<i>t-value</i>
INTERCEPT	49.04	2.51	19.55
CONTEXT NEUTRAL VS. ANAPHORIC	20.08	1.76	11.44
CONTEXT NEUTRAL VS. CATAPHORIC	18.93	1.76	10.78
TRIGGER OCCASION VS. ES	19.47	3.39	5.74
TRIGGER OCCASION VS. SE	9.92	3.39	2.92
NEUTR/ANA \times OCCASION/ES	-13.31	2.92	-4.55
NEUTR/ANA \times OCCASION/SE	-7.19	2.92	-2.46
NEUTR/CATA \times OCCASION/ES	-13.52	2.92	-4.62
NEUTR/CATA \times OCCASION/SE	-9.21	2.92	-3.15

Table 2: Parameter estimates for fixed effects in the global linear mixed-effects regression analysis (scaled to the interval [0, 100]) comparing occasion verbs with the two classes of psychological verbs of Experiment 2. Contrasts involved neutral contexts and occasion verbs, respectively, as reference levels for treatment coding. The intercept thus corresponds to the mean rating observed for the neutral condition of occasion verbs.

To summarize, we find a greater degree of projectivity and not-at-issueness for occasion verbs than for the other two major Implicit Causality verb classes in combination with a greater need for contextual support. The empirical support for these claims stems from occasion verbs in statements and questions. This raises the question whether their projectivity generalizes to other environments, too. In [Bott & Solstad 2022: Exp. 3](#), we investigated whether the effects obtained in Block 2 regarding projectivity and at-issueness generalize to other entailment-canceling environments, that is, the other Family-of-Sentences environments ([Chierchia & McConnell-Ginet 1990](#)). As we used a slightly different design in that experiment, we have chosen not to include it in this paper. The main finding was that although a somewhat weaker projection was observed for the antecedent of conditionals, the projective nature of the occasion implication triggered by occasion verbs generalizes to all Family-of-Sentence contexts.

4 Experiment 3: Left-right resolution (a)symmetry?

The previous experiments on the availability of anaphoric and cataphoric resolution of projective content showed that occasion verbs are unique among the triggers included in Experiments 1 and 2: They are the only triggers that demand their projective content to be entailed by context, but also allow for it to appear to the right of the trigger, that is, in subsequent discourse. This behavior is unexpected, and the availability of such symmetry is disputed in theoretical research as already discussed in the Introduction. One argument against treating occasion verbs as unique could be that there is something special about the causality of the occasion implication after a full stop: The results in Experiments 1 and 2 could potentially be explained with reference to discourse relations under the assumption that explanations are more easily integrated with a preceding independent sentence (we return to this issue in the General Discussion). Experiment 3 therefore tested cataphoric resolvability in an environment more typically used to investigate the filtering of projective content: for conjuncts in the antecedent of a conditional. In the Introduction, we discussed the study by [Mandelkern et al. \(2020\)](#), who found factive and aspectual verbs to be restricted to left-to-right filtering in this environment. If we were to find evidence of right-to-left filtering for occasion verbs under those very same conditions, this would constitute strong evidence that there is indeed something special about occasion verbs with respect to cataphoricity.

Our final experiment addresses Research Question (v) from above: *Do occasion verbs allow for left-to-right filtering of their projective content and to what extent do occasion verbs differ from other triggers of projective content in this regard?* The hypothesis entertained here is an interaction hypothesis:

- Occasion verbs pattern with other triggers in configurations allowing for left-to-right filtering of their projective content, but are qualitatively different from those other triggers in configurations testing for right-to-left filtering. (H8)

4.1 Design

Experiment 3 was built on design ideas in Mandelkern et al. 2020 (cf. Section 1.2). However, we tested for projectivity out of conditional antecedents in the “be certain that” paradigm applied in Experiments 1 and 2. To show that occasion verbs are indeed special, we were expecting to replicate their results for factive and aspectual verbs (Mandelkern et al. 2020: Exp. 3) while showing that occasion verbs allow for symmetric filtering. The experiment employed a 2×3 within participants and between items design manipulating the factors TRIGGER TYPE (*occasion verb* vs. *other triggers* taken from Mandelkern et al. 2020) and ANTECEDENT TYPE (*trigger first/projective content right-conjoined* vs. *trigger last/projective content left-conjoined* vs. *trigger only*). The dependent variable was again a projectivity rating in the form of the answer to a *be certain that* question targeting speaker commitment by means of a slider as in the previous experiments.

The resulting three conditions are shown for the occasion verb *gratulieren* ‘congratulate’ in (28) with the corresponding *be certain that* diagnostics in (29):

- (28) a. **trigger first:**
Wenn [_{St} Peter Nathalie gratuliert hat] und [_{Sp} sie tags zuvor einen Laufwettbewerb gewonnen hat], dann wird Lars ihr einen Blumenstrauß schicken.
 ‘If [_{St} Peter congratulated Nathalie] and [_{Sp} she won a running competition the day before], then Lars will send her a bouquet of flowers.’

b. **trigger last:**

Wenn [Sp Nathalie einen Laufwettbewerb gewonnen hat] und [St Peter ihr dazu gratuliert hat], dann wird Lars ihr einen Blumenstrauß schicken.

‘If [Sp Nathalie won a running competition] and [St Peter has congratulated her thereon], then Lars will send her a bouquet of flowers.’

c. **trigger only:**

Wenn [St Peter Nathalie zum Sieg beim Laufwettbewerb gratuliert hat], dann wird Lars ihr einen Blumenstrauß schicken.

‘If [St Peter congratulated Nathalie on winning the running competition], then Lars will send her a bouquet of flowers.’

(29) **Projectivity question:**

Ist sich die Sprecherin sicher, dass es für Peter einen Anlass gab, Nathalie zu gratulieren?

‘Is the speaker certain that there was an occasion for Peter to congratulate Nathalie?’

The *trigger first* condition in (28a) is the crucial condition, testing for the availability of right-to-left filtering, where the trigger occurs in the first conjunct and the projective content is contained in the second conjunct. Conversely, *trigger last* conditions (28b) tests for left-to-right filtering, with the trigger occurring in the right conjunct. The *trigger only* condition (28c) serves as a baseline condition. In this condition, projection should always occur since no filtering whatsoever takes place.

Several things are of note here. In the *trigger first* and *trigger last* conditions, the second conjunct was modified to increase general discourse felicity in several ways. Thus, personal pronouns were used to refer back to referents introduced in the first conjunct, compare (28a) and (28b). Furthermore, in the *trigger only* conditions (28c), the projective content was included to keep the items comparable with the ‘Mandelkern items’, since a verb like *know* requires its complement, and thus its projective content, to be realized syntactically. We take this to be unproblematic, since Block 2 of Experiments 1 and 2 already showed that this content projects when it is not specified. Furthermore, we compared implicit occasions in Experiments 1 and 2 and explicit occasions in Bott & Solstad 2022. This comparison in fact revealed a similar projection of implicit and explicit occasion events. Next, to keep the *trigger last* conditions (28b) as close to the *trigger only* conditions as

possible, a pronominal adverb was included (e.g., *dazu* ‘thereon’ with the same preposition as in the *trigger only* condition; the *da-* prefix is discourse-anaphoric but not a pronoun in the proper sense). This should also make clear that the eventuality upon which the agent was acting was the one included in the first conjunct, and not some other, unmentioned eventuality. Finally, as no pronominal adverb could be used in the *trigger first* conditions (28a) for independent reasons, a temporal adverbial was used instead to specify the order of the events described in the two conjuncts. This way, we made sure that the eventuality that we intended to be understood as an occasioning eventuality was interpreted to occur before the event described by the occasion verb.

4.2 Methods

4.2.1 Materials

We created 24 items for the 16 occasion verbs from the other experiments by constructing a second experimental item for eight of the verbs. These eight verbs were balanced with respect to the social-emotional valuation of the predicates (see Section 1.1), with four positively valuated predicates like *belohnen* ‘reward’ and four negatively valued verbs like *kritisieren* ‘criticize’. A translated example item for *congratulate* was shown in (28) above. These items should trigger responses trending towards certainty in the *trigger only* conditions. If symmetric filtering occurs, however, responses trending towards uncertainty are expected in both *trigger first* and *trigger last* conditions. Thus, two out of three occasion verb trials should trigger a ‘no’ response with regard to speaker certainty.

In addition to our 24 items, we included slightly modified versions of the 24 critical items (in the same three conditions) from the study by Mandelkern et al. (2020). These items involved four well-established triggers of projective content: *sich freuen, dass* ‘be happy that’, *wissen* ‘know’, *aufhören* ‘stop’ and the adverb *weiterhin* ‘still’, corresponding to *continue*. The original materials from Mandelkern et al. 2020 were translated by a native speaker of German studying English philology. Since Mandelkern et al. showed these items to display a left-to-right filtering asymmetry, we expected only the *trigger first* condition to trigger responses trending towards uncertainty (since the content should project in these cases). Thus, for these 24 items, two thirds of the trials should trigger ‘yes’ responses with regard to speaker certainty.

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32 fillers of four different kinds were added to the experimental materials, fulfilling several important functions. First, we included eight conditionals without any triggers of projective content of relevance here that should elicit ‘no’ answers to the certainty question:

- (30) a. **Assertion:**
“Wenn Theo in einem Restaurant arbeitet, dann wird Anja ihn bitten, bei ihrer Feier zu kochen.”
‘If Theo works in a restaurant, then Anja will ask him to cook at her party.’
- b. **Question:**
Ist sich die Sprecherin sicher, dass Theo in einem Restaurant arbeitet?
‘Is the speaker certain that Theo works in a restaurant?’

Likewise, we included eight causally connected sentences which should trigger ‘yes’ responses due to the factivity of the causal connectives *weil* ‘because’ and *da* ‘since’:

- (31) a. **Assertion:**
Weil Olivia nie ins Fitnessstudio gegangen ist, wird Emil sie einladen, mit ihm zu trainieren.
‘Because Olivia has never gone to the gym, Emil will invite her to work out with him.’
- b. **Question:**
Ist sich die Sprecherin sicher, dass Olivia nie ins Fitnessstudio gegangen ist?
‘Is the speaker certain that Olivia has never gone to the gym?’

Furthermore, the eight occasion verbs that were not tested twice were included in the antecedent of conditionals, but this time we asked for the main verb itself. These fillers should also trigger ‘no’ responses in the present projectivity rating task:

- (32) a. **Assertion:**
Wenn Svenja für das Fahren ohne Ticket belangt wurde, wird Pascal ihr sein altes Fahrrad leihen.
‘If Svenja was charged for driving without a ticket, Pascal will lend her his old bike.’

b. **Question:**

Ist sich die Sprecherin sicher, dass Svenja belangt wurde?
 ‘Is the speaker certain that Svenja has been charged?’

Finally, eight fillers involved questions with non-projective predicates modified by *grundlos* ‘for no good reason’:

(33) a. **Assertion:**

Hat Britta Ingo grundlos beschimpft?
 ‘Did Britta insult Ingo for no reason?’

b. **Question:**

Ist sich die Sprecherin sicher, dass es für Britta einen Anlass gab, Ingo zu beschimpfen?
 ‘Is the speaker certain that there was a reason for Britta to insult Ingo?’

Again, we expected these fillers to trigger ‘no’ responses, trending towards uncertainty. Overall, the experiment thus included 32 trials that should trigger ‘yes’ responses and 48 trials that should tend to trigger ‘no’ responses.

4.2.2 Participants

75 native German participants were recruited via Prolific, none of whom participated in the first two experiments. They were paid 2.70 GBP in compensation for their participation. An experimental session lasted approximately 20 minutes (median of 20.2 minutes, range 9–62 minutes). 17 participants were excluded from the analysis because of poor performance on the fillers in the following cases: If they showed a tendency in the wrong direction with, for instance, more than 50% certainty for fillers that should trigger uncertainty responses as in non-projective conditionals (30). Or, if independent samples *t*-tests, separately conducted for each participant, showed them not to distinguish reliably ($p \geq .05$) between fillers for which the expected answers were ‘yes’ or ‘no’, respectively. As a result, 58 participants remained in the analysis (mean age 24.1 years, range 19–35 years; 34 female, 23 male, 1 other). No explicit attention checks were used.

4.2.3 Procedure

The experiment employed the same procedure as Block 2 in the previous two experiments with one minor change. Because the conditional conditions involved an additional referent in this experiment, we refrained from referring to the speaker by a proper name, as it was done in Experiments 1 and 2, see (22). Instead, the dialogue setting was established by means of graphical illustration of the party context. The *be certain that* questions always addressed speech acts of the female speaker, see (29). A screenshot from a sample trial is shown in Figure 8.

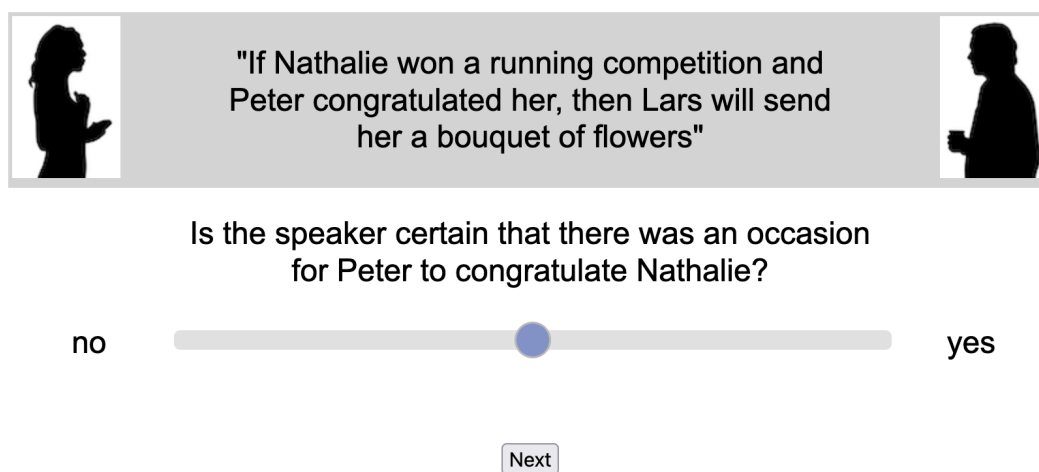


Figure 8: Sample trial from Experiment 3 displaying the assessment of projectivity for the *trigger last* condition for *gratulieren* 'congratulate'. Display translated to English, see example (28b).

Participants received a short practice of two trials before the main experiment. One practice trial queried a judgment about clearly projective content and the other about a non-projective assertion.

4.3 Results and discussion

Figure 9 presents the mean projectivity ratings in Experiment 3 for occasion verbs and German equivalents of the factive and aspectual triggers investigated by Mandelkern et al. (2020).

Focusing first on the triggers investigated by Mandelkern et al., the present experiment replicates their central finding that right-to-left filtering (*trig-*

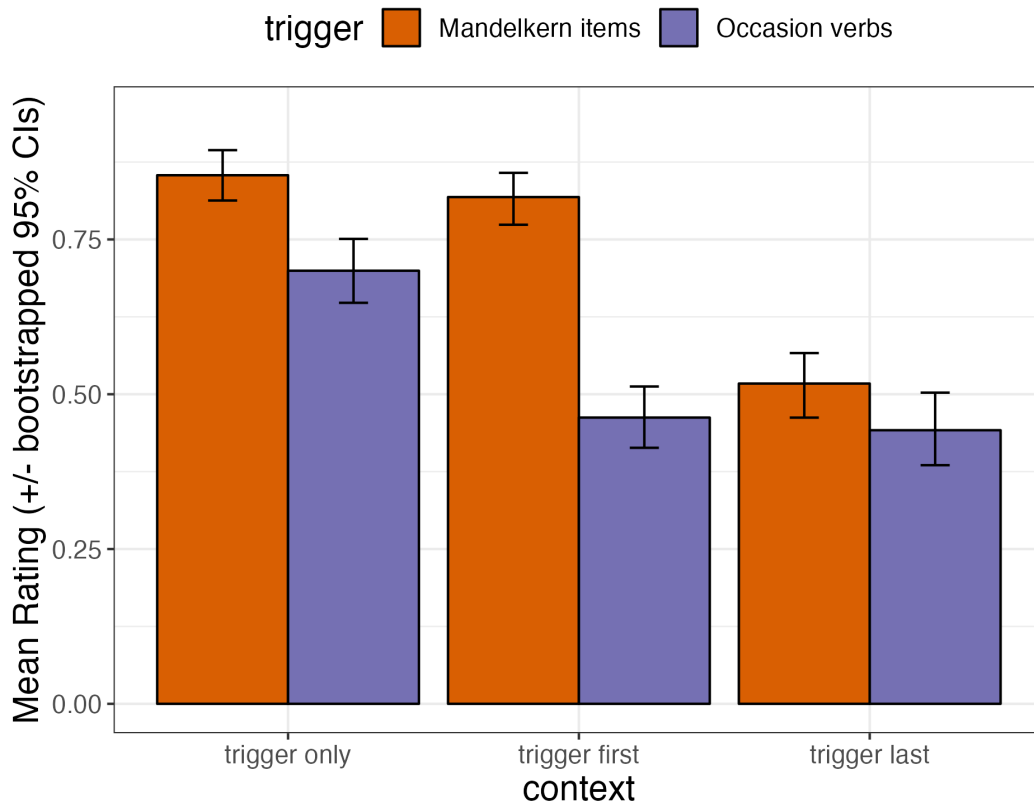


Figure 9: Mean projectivity ratings (and bootstrapped 95% confidence intervals) comparing occasion verbs with German translations of the materials and triggers tested in Mandelkern et al. 2020.

ger first conditions) is hardly available for these triggers, since projectivity ratings were as high in the *trigger first* condition as they were in the *trigger only* baseline control condition. Hence, it may be concluded that the material in the right conjunct cannot filter any projective content in the left conjunct for these aspectual and factive triggers. These two conditions received much higher projectivity ratings than the *trigger last*, left-to-right filtering condition, in which the justifying content preceded the trigger. Thus, the present experiment indicates that the methods adopted from Tonhauser, Beaver & Degen 2018 with its speaker commitment task are well suited to replicate the central findings of the inference task in Mandelkern et al. 2020. Moreover, we received clear-cut ratings for the four types of filler constructions included in the study with mean ratings of ≥ 0.9 for each of the filler cate-

gories for which *yes, the speaker is certain* ratings were expected and ≤ 0.2 for each of the filler types for which *no* responses were expected.⁹

The projectivity ratings of occasion verbs showed a fundamentally different pattern than the triggers from Mandelkern et al. Here, the crucial *trigger first* condition patterned with the *trigger last* condition, both of which displayed the same extent of filtering. While this is expected on all accounts for the *trigger last* condition as confirmed by the results for the ‘Mandelkern items’ in this condition, the increased presence of filtering in the *trigger first* condition is surprising based on assumptions in previous research. Of further importance, these two conditions clearly differed from the *trigger only* condition.

The pattern just outlined turned out to be statistically reliable. The present 2 (TRIGGER TYPE) \times 3 (ANTECEDENT TYPE) within design was subjected to an LMER analysis on projectivity ratings with a centered fixed effect of TRIGGER TYPE and a treatment-coded fixed effect of ANTECEDENT TYPE with the TRIGGER FIRST condition as base category and a first contrast comparing it to the TRIGGER LAST condition and a second contrast comparing it to the TRIGGER ONLY condition. In addition, the models included by-participants and by-items random intercepts. The model is summarized in Table 3 with all estimates scaled from the interval [0, 1] to [0, 100] for better readability.

The analysis revealed two significant interactions. First, the interaction between the first contrast (*trigger first* vs. *trigger only*) and the factor TRIGGER TYPE was significant. Second, the interaction between the second contrast (*trigger first* vs. *trigger last*) and the factor TRIGGER TYPE was significant, too. Follow-up analyses were computed to break down the latter interaction, which is crucial for the present discussion. Regression models on subsets of the data showed that for occasion verbs there was no reliable difference between the *trigger first* and the *trigger last* condition ($\chi^2(1) = 1.30$, $p = .26$). Exactly the opposite pattern was observed for the Mandelkern triggers with a significant difference between the *trigger first* and the *trigger last* condition ($\chi^2(1) = 207.6$, $p < .001$).

Taken together, the findings of the present experiment are clear with respect to the possibility of right-to-left filtering: While the factive and aspectual triggers adopted from Mandelkern et al. 2020 do not seem to support right-to-left filtering and thus show highly asymmetric filtering properties, the occasion verbs proved to show completely symmetrical filtering properties.

⁹ The only exception to these very clear trends were the fillers using occasion verbs (32) with a mean rating of 0.28.

	<i>estimate</i>	<i>SME</i>	<i>t-value</i>
A) INTERCEPT	64.01	1.86	34.51
TRIG 1ST/TRIG ONLY	13.63	1.36	10.06
TRIG 1ST/TRIG LAST	-16.02	1.36	-11.82
TRIG TYPE	-35.66	2.25	-15.82
TRIG 1ST/TRIG ONLY \times VERB TYPE	20.20	2.72	7.45
TRIG 1ST/TRIG LAST \times TRIG TYPE	28.24	2.71	10.42
B) INTERCEPT	46.21	2.32	19.93
TRIG 1ST/TRIG ONLY	23.72	1.88	12.60
TRIG 1ST/TRIG LAST	-1.97	1.88	-1.05
C) INTERCEPT	81.85	2.34	34.92
TRIG 1ST/TRIG ONLY	3.53	1.85	1.91
TRIG 1ST/TRIG LAST	-30.16	1.85	-16.33

Table 3: Parameter estimates (scaled to the interval [0, 100]) for fixed effects in the linear mixed-effects regression analysis comparing occasion verbs with factive verbs of Experiment 3 (Analysis A: global LMER analysis). Follow-up analyses for occasion verbs (Analysis B) and triggers from Mandelkern et al. 2020 (Analysis C) are reported breaking down the interactions. Abbreviations: TRIG 1ST = TRIGGER FIRST, TRIG LAST = TRIGGER LAST, TRIG ONLY = TRIGGER-ONLY. Contrasts involved TRIGGER FIRST as reference level for treatment coding. The intercept thus corresponds to the mean rating observed for these conditions.

5 General discussion

The present study investigated the projective potential of occasion verbs, a class made up of ‘agent-evocator’ verbs like *congratulate*, *criticize* or *praise*, which are well-known from psycholinguistic investigations of Implicit Causality (see, in particular, Au 1986, Bott & Solstad 2014, 2021, Solstad & Bott 2023). Although this verb class has mostly gone unnoticed in theoretical investigations of triggers of projective content, individual verbs have been discussed in connection with Fillmore’s judgments verbs (Fillmore 1969). We argued that occasion verbs are triggers of projective content that may be characterized as an implication that an eventuality prior to the action described by the occasion verb constituted a reason for the agent’s action. To our knowledge, this is the first study to examine the projectivity of occasion verbs outside the sentence-completion paradigm used in Implicit Causality research and

also the first study to use the methods developed by [Tonhauser et al. \(2013\)](#) and [Tonhauser, Beaver & Degen \(2018\)](#) to investigate this verb class.

Experiments 1 and 2 investigated two main properties of occasion verbs, comparing them to a number of other, well-established triggers of projective content: First, using the methods established in [Tonhauser, Beaver & Degen 2018](#) for (polar) question contexts, we found evidence for Hypotheses H1 and H2: Like factive and aspectual verbs, personal pronouns, clefts, definite descriptions, *too*, and *again*, occasion verbs are rated high in projectivity, yet comparably low in at-issueness. These results replicated the negative correlation between these two features found in, for instance, [Tonhauser, Beaver & Degen 2018](#). More specifically, a joint cluster analysis of Experiment 1 and 2 confirmed that occasion verbs patterned with triggers like personal pronouns, definites and *too* with regard to projectivity and at-issueness. Second, we also found occasion verbs to be the only trigger type to allow for their projective content to be resolved in subsequent discourse (as in *Peter congratulated Mary. She had won a race.*). As such, this is a case not covered by [Tonhauser et al.'s \(2013\)](#) original definition of strong contextual felicity: To account for these cases, we introduced a differentiation of *m*-positive contexts into *m*-anaphoric and *m*-cataphoric contexts. Among the triggers that impose a strong contextual felicity constraint (as formulated in Hypothesis H3, based on [Tonhauser et al. 2013](#)), occasion verbs were the only triggers to allow for cataphoric resolution, as formulated in Hypotheses H4 and H5.

While replicating the results for occasion verbs in Experiment 1 and extending the comparison to additional triggers of projective content, Experiment 2 additionally included stimulus-experiencer and experiencer-stimulus verbs, two other major classes of Implicit Causality verbs. The results showed that while these verbs allow for explanations to follow or precede them (H6), they do not cluster with occasion verbs and other triggers of projective content (H7), indicating that they should not be given the same analysis as occasion verbs, as already suggested by [Bott & Solstad \(2014\)](#).

Finally, in Experiment 3 we investigated the filtering properties of occasion verbs in conjunctions in the antecedent of conditionals. While we replicated the left-to-right filtering asymmetry found by [Mandelkern et al. \(2020\)](#) for factive and aspectual predicates, we importantly also found occasion verbs to allow for symmetric filtering in these contexts (H8). This goes against the general conclusion in [Mandelkern et al. 2020](#) that asymmetric filtering is excluded in these constructions. We take this as strong evidence in support of the results from Experiments 1 and 2 that occasion verbs dis-

play highly particular properties in terms of their potential for cataphoric resolution.

In sum, we take the results from Experiment 1 through 3 to support the conclusion that occasion verbs do indeed constitute a class of triggers of projective content deserving a cage of its own in the zoo of triggers:

- i. The occasion implication is projective and not-at-issue in polar questions to an extent comparable to other triggers of projective content.
- ii. Sentences with triggers of occasion implications are less natural in *m*-neutral contexts than in *both m*-anaphoric and, crucially, *m*-cataphoric contexts.
- iii. In the antecedent of a conditional, the occasion implication is significantly less projective both when it is preceded or, importantly, followed by a conjunct entailing the content, than when the trigger occurs alone.

Surely, the most intriguing and possibly also most controversial property of occasion verbs is their potential for cataphoric resolution in discourse (point ii above), and, ultimately, symmetric filtering in the antecedent of conditionals, that is, left-to-right and right-to-left (point iii). Turning first to previous experimental evidence, we are aware of no other investigation offering evidence of symmetric filtering for conjunctions in the antecedent of conditionals. In fact, as mentioned above, Mandelkern et al. (2020) explicitly argued against right-to-left filtering (using a different experimental design). First experimental studies that may be taken to support that right-to-left filtering is available, showed such effects either only for adverbs like French *aussi* ‘too’ in the first disjunct of sentences conjoined by *ou* ‘or’ (Chemla & Schlenker 2012) or for *again* occurring in simplex antecedents of conditionals (Brasoveanu & Dotlačil 2015, 2020). More recently, however, Kalomoiros & Schwarz (2021) found filtering to be symmetric for disjunctions in the same experimental paradigm that showed it to be excluded for conjunctions by Mandelkern et al. (2020), as discussed in Section 1.2.

Experiments 1 and 2 add to the evidence of symmetric filtering, showing that occasion verbs allow for the resolution of their projective content in subsequent discourse, that is, across sentence boundaries in the absence of discourse connectives (point ii above). This is notable, since theoretical proposals allowing for symmetric filtering (Schlenker 2009, Kalomoiros 2024) have, as we noted in the Introduction, been limited to conditionals or sen-

tences conjoined by *or*, that is, constructions involving embedding or particular connectives.

Consequently, the above evidence poses a challenge to existing theories of projectivity and, in particular, the resolution of projective content. Under the theories that allow for filtering symmetry, it seems to us that the proposal by Schlenker (2009) comes closest to fitting the bill. However, while Schlenker's symmetric notion of local contexts could help explain the results on filtering in Experiment 3, the assumed mechanisms are only applicable sentence-internally and cannot thus be extended to the multi-sentence discourses in Experiments 1 and 2.

As an alternative, it has been suggested to us that we're dealing with a case of local accommodation, as in the proposal by Hirsch & Hackl (2014). The general idea would be to assume that the occasion implication is always locally accommodated, but that it can still be specified in subsequent context. This could be tied to the nature of explanations, which are of central importance for occasion verbs (see the Introduction; see also below). While the evidence from Experiments 1 and 2 is compatible with assuming local accommodation, we believe that the results from Experiment 3 offer evidence against this assumption: If local accommodation would be taking place, we would expect the *trigger only* condition on the one hand (*If Peter congratulated Nathalie, then ...*) and the *trigger last* condition on the other (*If Nathalie won a race and Peter congratulated her, then ...*) to be equally projective. This is not what we found, however: The *trigger last* condition was numerically even less projective than the *trigger first* condition, which turned out to be less projective than the *trigger only* condition.

The results of our experiments should not be taken to cast doubt on the general preference for left-to-right filtering, or, more generally, incremental processing of projective content. Rather, it seems plausible that there is some special property of occasion verbs that makes cataphoric resolution and right-to-left filtering more available. Short of having a full-fledged analysis to offer, our current thinking is that this peculiar behavior could be related to the causality involved in the occasion implication. If an occasion verb is used, the occasion implication will lead to a Question under Discussion (QUD) as to *Why?*, which must be addressed (Roberts 1996). This gives rise to an interesting possibility: Rather than being *entailed* by the (preceding) context, as is commonly assumed for projective content, it could be that an occasion implication — raising a QUD — *must be addressed (in context)* — be it before or after the occurrence of the trigger. Importantly, in sequences

of discourse segments without an explicit connective, causes and effects may indeed occur in any order, as witnessed by the results for occasion verbs in Block 1 of Experiments 1 and 2 (investigating *m*-anaphoric and *m*-cataphoric contexts). Since an unmodified clause containing the occasion verb can be directly identified as the effect in a causal relation, a cause can be easily integrated — even though it violates ordering principles such as causes being presented before their effects (e.g., Horn 2019, Tversky & Kahneman 1982).

While we haven't so far studied other verb classes beyond occasion verbs, one could speculate that predicates of change of state that can be externally caused, such as *fall*, or intransitive *break* could be worthwhile candidates to investigate with regard to cataphoric resolution. Also, implicative verbs such as *manage*, which have been argued by Baglini & Francez (2016) and Nadathur (2023) to presuppose a causal network, constitute interesting cases in point.

Some further questions emerge related to the property of cataphoric resolvability of projective content put forward in the present paper. In all experiments presented here, cataphoricity was limited to the immediately following sentence. If we are dealing with a real discourse phenomenon, which the existing research on Implicit Causality may lead us to expect, we should find cataphoricity to extend much further rightwards in the subsequent context (see, however Simner & Pickering 2005). Thus, the following example seems to be equally acceptable with or without the intervening sentence separating the trigger from the occasioning eventuality mentioned in the final sentence:

- (34) John criticized Peter. He went on berating Peter all evening. Peter had not dared to defend his wife against the false accusations.

Another question relates to further consequences of the projection behavior of occasion verbs. If the present proposal is on the right track, we might expect to find projection to the right context in contexts apart from the assertive cases employed in Implicit Causality. A case in question are occasion verbs in the scope of negation such as *John did not criticize Peter*. Here, the need to elaborate on the occasioning eventuality intuitively still seems to be rather strong. In this case, however, the occasion implication should give rise to a discourse relation of violated expectation (e.g., Kehler 2002, Lagerwerf 1998), as, for instance, *although he had not defended his wife against the false accusations*. More experimental work is required to see whether continuations of this type are indeed the preferred way to continue the discourse.

Turning briefly to theories on Implicit Causality, another upshot of our findings is that there is probably not one lexical feature common to all Implicit Causality verbs. In previous research, [Bott & Solstad \(2014\)](#) and [Solstad & Bott \(2022, 2023\)](#) argued that the combined discourse and coreference bias towards explanations about particular referents comes about through an Empty Slot mechanism. In fulfilling the bias, we thus follow a preference for not leaving information unspecified. However, as hypothesized theoretically in [Bott & Solstad 2014, 2021](#) and indicated by the results in Experiment 2, this underspecification has different sources: Psychological verbs of stimulus-experiencer and experiencer-stimulus type do not pattern with occasion verbs in terms of projectivity and at-issueness. This results supports the analysis in [Bott & Solstad 2014, 2021](#) that (at least) two different lexical properties are involved in triggering the coreference and coherence biases (for discussion, see [Bott & Solstad 2014, Solstad & Bott 2022](#)).

6 Conclusions

The present study has provided evidence for a class of triggers of projective content that we have suggested to characterize as occasion verbs. Verbs like *congratulate* are associated with the (projective) implication that an eventuality prior to the action described by the occasion verb gave the agent reason to act the way they did. In a cluster analysis, we showed that these verbs pattern with other, well-established triggers with regard to projectivity and at-issueness (cf. [Tonhauser, Beaver & Degen's \(2018\) Gradient Projection Principle](#)). Equally significant, we provided evidence that occasion verbs are special in allowing for cataphoric resolution, both across independent discourse segments and in conjunctions in the antecedent of conditionals. We suggested that this property is grounded in the explanatory relation between the event introduced by the occasion verb and its projective implication.

A Supplementary materials

A.1 Models fitted in Experiments 1 through 3

Model equations of linear mixed effects regression models in R syntax. Models were fit with R's `lme4` package ([Bates et al. 2015](#)). Contrasts were specified using treatment coding, reference levels shown in bold face.

A.1.1 Experiment 1 (block 1)

- Model 1: Occasion verbs only

rating~ 1 + context +
 (1 + context|participant) +
 (o + context|item)

	estimate	SME	t-value
(Intercept)	50.81488	3.044438	16.691056
anaphoric vs. neutral	22.36848	2.842220	7.870075
cataphoric vs. neutral	17.92551	2.411728	7.432642

- Model 2: Occasion verbs vs. pronouns and demonstrative NPs

rating~ 1 + context * trigger +
 (1 + context|participant) +
 (o + context|item)

	estimate	SME	t-value
(Intercept)	50.80963	2.712278	18.733194
anaphoric vs. neutral	22.36933	2.719386	8.225876
cataphoric vs. neutral	17.94646	2.141555	8.380107
demonstrative vs. occasion	-26.30148	4.323596	-6.083243
pronoun vs. occasion	-26.54358	4.323575	-6.139266
ana/neut × occ/dem	24.05649	5.149543	4.671577
ana/neut × occ/pron	42.27367	5.149521	8.209243
cata/neut × occ/dem	-12.72390	4.167543	-3.053094
cata/neut × occ/pron	-17.36018	4.153335	-4.179817

Occasion verbs

- Model 3: Follow-up analysis of pronouns only

$$\text{rating} \sim 1 + \text{kontext} + \\ (1 | \text{vp}) + \\ (1 | \text{item})$$

	estimate	SME	t-value
(Intercept)	24.2988370	4.548308	5.3423900
cataphoric vs. neutral	0.6103453	3.821548	0.1597115

- Model 4: Follow-up analysis of demonstratives only

$$\text{rating} \sim 1 + \text{kontext} + \\ (1 | \text{vp}) + \\ (1 | \text{item})$$

	estimate	SME	t-value
(Intercept)	24.408451	3.160166	7.723788
cataphoric vs. neutral	5.501836	3.950140	1.392821

A.1.2 Experiment 2 (Block 1)

- Model 1: Occasion verbs only

$$\text{rating} \sim 1 + \text{context} + \\ (1 + \text{context} | \text{participant}) + \\ (1 + \text{context} | \text{item})$$

	estimate	SME	t-value
(Intercept)	48.97851	2.913119	16.813084
anaphoric vs. neutral	20.03165	3.047886	6.572309
cataphoric vs. neutral	19.03099	2.805464	6.783546

- Model 2: Occasion verbs vs. *auch* ('too')

rating ~ 1 + context * trigger +
 (1+context | participant) +
 (1+context | item)

	estimate	SME	t-value
(Intercept)	45.200000	5.186983	8.714122
anaphoric vs. neutral	30.283333	5.092769	5.946340
cataphoric vs. neutral	4.600000	4.569410	1.006694
occasion vs. <i>too</i>	3.741183	5.240794	0.713858
ana/neut × occ/ <i>too</i>	-10.214773	5.066099	-2.016300
cata/neut × occ/ <i>too</i>	14.450951	4.459373	3.240579

- Model 3: Occasion verbs vs. psych verbs (SE- and ES-verbs)

rating ~ 1 + context * trigger +
 (1 | participant) +
 (1 | item)

	estimate	SME	t-value
(Intercept)	49.043739	2.508065	19.554409
anaphoric vs. neutral	20.080324	1.755776	11.436724
cataphoric vs. neutral	18.929084	1.755776	10.781037
es verb vs. occasion	19.467372	3.391804	5.739534
se verb vs. occasion	9.917372	3.391804	2.923923
ana/neut × occ/es	-13.313657	2.924745	-4.552074
ana/neut × occ/se	-7.185880	2.924745	-2.456925
cata/neut × occ/es	-13.523529	2.924745	-4.623831
cata/neut × occ/se	-9.212418	2.924745	-3.149819

A.1.3 Experiment 3

- Global model: Occasion verbs vs. Mandelkern items

$$\text{rating} \sim 1 + \text{trigger} * \text{condition} +$$

$$(1 | \text{participant}) +$$

$$(1 | \text{item})$$

	estimate	SME	t-value
(Intercept)	64.01321	1.85497	34.509066
occasion vs. Mandelkern items	-35.66416	2.25398	-15.822726
P first vs. simple P	13.62978	1.35555	10.054802
P first vs. P last	-16.02450	1.35557	-11.821223
occ/mand × P first/simple P	20.19997	2.71110	7.450843
occ/mand × P first/P last	28.23977	2.71114	10.416194

- Model 2: Occasion verbs only

$$\text{rating} \sim 1 + \text{condition} +$$

$$(1 | \text{participant}) +$$

$$(1 | \text{item})$$

	estimate	SME	t-value
(Intercept)	46.20633	2.31802	19.933535
P first vs. simple P	23.72361	1.88264	12.601215
P first vs. P last	-1.97406	1.88264	-1.048556

- Model 3: Mandelkern items only

$$\text{rating} \sim 1 + \text{condition} +$$

$$(1 | \text{participant}) +$$

$$(1 | \text{item})$$

	estimate	SME	t-value
(Intercept)	81.85070	2.34383	34.921700
P first vs. simple P	3.52636	1.84675	1.909492
P first vs. P last	-30.15676	1.84683	-16.328951

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