

The evidential reading of German locative *an*¹

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Abstract. German inferential perception verbs license an evidential reading of PPs headed by *an*: They refer to the information source of an inference and to directly perceived entities (Müller, 2020). This paper aims to show that this reading of *an* is derivable from its basic locative meaning by compositional means. This is achieved by analyzing evidential *an*PPs as event-internal modifiers in the framework of Two-level-semantics (Lang and Maienborn, 2019). Results of a corpus study show that evidential *an*PPs refer to bearers of tropes which provide the contextually relevant information source and are perceivable on the bearer's boundary surface. This is predicted by the locative meaning of *an* as worked out in Carstensen's (2000; 2015) cognitivist-attentional approach.

Keywords: Perception, inferences, *an*, evidentiality, tropes.

1. Introduction

In German, prepositional *an*-phrases² (in the following: *an*PPs) may indicate the source of an inference drawn by the subject referent. In this sense, the *an*PPs in (1)–(2) are interpreted evidentially: the conclusion, expressed by the *that*-clause, is based on the content of the *an*PP. Following Aikhenvald (2007), evidentiality is here taken as a semantic-functional domain referring to information sources, or evidence, on which attitude holders base their conclusions.

- (1) a. Kim merkte an den Blättern, dass Herbst war.
Kim noticed at the leaves that autumn was
'Kim noticed from the leaves that it was autumn.'
- b. An der offenen Tür merkte Marie, dass John zuhause war.
at the open door noticed Mary that John home was
'Mary noticed from the open door that John was home.'
- (2) a. An dem blutigen Messer sah Margarete, dass Maria den König umgebracht hat.
at the bloody knife saw Margret that Mary the king killed has
'Margret saw from the bloody knife that Mary has killed the king.'
- b. An dem Geräusch hörte Margarete, dass Maria den König umgebracht hat.
at the sound heard Margret that Mary the king killed has
'Margret heard from the sound that Mary has killed the king.'

(Müller, 2020: 60, (13a-b))

*An*PPs that exhibit an evidential interpretation are already attested in earlier stages of the German language for *scheinen* 'to appear', 'to seem'; cf. Axel-Tober and Müller (2017); Müller (2022), and refer to directly perceived entities (Müller, 2020). They are semantically restricted

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²The German preposition *an* in this reading is not easily translatable to English. In the evidential reading, it is probably best translated with 'from'. However, I will use the English locative preposition 'at' as translation throughout this paper, because my main desideratum is to derive the evidential reading from the locative one.

to predicates that express a reasoning that is based on perception. Typically, inferences as results of reasoning processes are expressed by finite *that*-clauses as complements of cognitive verbs. Perception, on the other hand, is a sensory experience and typically expressed by perception verbs (PVs) that may encode a specific sensory channel (like the auditory system for the verb *hear*).

This paper addresses the following questions: (i) In which contexts does the evidential reading arise, and how does the *an*PP compose with the embedding verbs? (ii) What is the specific, lexical meaning contribution of the preposition *an*? (iii) To what kind of entities do information sources refer? The aim of this work is to show that the evidential reading of *an* is entirely derivable from the locative one, which is taken as its primary basic meaning. The key argumentation is that the embedding verbs form a certain group of experiencer-stimulus-verbs that provide an implicit stimulus argument in their event structure. Evidential *an*PPs overtly realize the thematic role of the stimulus. The basic locative meaning of *an* predicts that the stimulus is located at the surface of the *an*-internal referent or constitutes a part of it.

The paper is structured as follows: Section 2 introduces the contexts that license the evidential reading of *an* and proposes a lexical structure for the embedding verbs. Section 3 offers an overview to relevant works on the preposition *an* and proposes an analysis of evidential *an*PPs as event-internal modifiers along the lines of Maienborn (1996; 2001; 2003). A compositional analysis based on the locative reading of *an* is given in Section 4. Section 5 presents the results of a corpus study that permit a more detailed look on the phenomenon from an ontological perspective. This is elaborated in Section 6. A brief conclusion is given in Section 7.

2. Semantic restrictions on the context for evidential *an*

In this section, I will show that the evidential reading of *an*PPs arises only in the context of predicates that a) have a propositional complement that expresses an inference, and b) imply a perception stimulus. Verbs showing these properties can be grouped together under the notion of *inferential perception verbs* (IPVs)³. Based on the observed data, a decompositional structure for IPVs is set up at the end of this section.

2.1. The inferential component

Evidential *an*PPs are only compatible with predicates that describe an inference of the subject referent. Major evidence for this is found in the incompatibility of evidential *an*PPs with PVs in their direct reading. The PV *see* in (3) shows a direct or ‘epistemic neutral’ reading (see e.g. Gisborne, 2010; Bayer, 1986), in that the complement refers to a directly perceived entity and realizes the thematic role of a stimulus.

- (3) a. Margret saw Mary.
b. Margret saw Mary kill the king.

³IPVs are selectional flexible in embedding not only *that*-clauses, but also *wh*-clauses, as well as trope-referring NPs like in (12). Since this paper focuses on the meaning of *an*PPs, I will not discuss the status of the verb complements here.

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The syntactic form of the complements reflects ontological restrictions for direct (sensory) perception: Possible objects of perception are concrete entities that are situated in space and time and realized in a unique way. This is fulfilled by physical objects as in (3a) and Davidsonian eventualities⁴ as in (3b). Evidential *an*PPs are not compatible with the direct reading of PVs (Müller, 2020: 61), because it lacks an inferential component:

- (4) a. *Margarete sah Maria / den Mord an dem blutigen Messer.
Margret saw Mary / the murder at the bloody knife
b. *Margarete hörte Maria den König umbringen an dem Geräusch.
Margret heard Mary kill the king at the sound

Instead, they only occur with PVs in their indirect or inferential reading with a propositional complement as shown in (2). It is commonly acknowledged that *see* in (2a) is used in a cognitive sense such that the complement clause expresses a conclusion made by the subject referent, see e.g. Bayer (1986); Gisborne (2010); Whitt (2010); Müller (2020).

Further, Müller (2020: 69,73) points out that the clausal complement must indeed exhibit an inferential reading. This restriction is best illustrated with the PV *hören* ‘hear’, which is typically interpreted as reportative when it embeds a finite *that*-clause as in (5a). In this reading, the *that*-clause refers to the content of a report that Mary received from a third party like the news. As (5b) shows, it is not possible to refer to the report-medium with an *an*PP. Thus, *an*PPs are ruled out in the reportative reading of *höören*.

- (5) a. Margarete hörte, dass Marie den König umgebracht hatte.
Margret heard that Mary the king killed has
(Müller, 2020: 60, (12a))
b. *An den Nachrichten hörte Margarete, dass Maria den König umgebracht hat.
at the news heard Margret that Mary the king killed has

However, if the *an*PP refers to a sound-object like in (2b), an inferential reading of *hören* is triggered, leading to an evidential interpretation of the *an*PP. Thus, only in case the embedded proposition expresses an inference, an *an*PP may refer to a “piece of evidence from which a conclusion can be drawn” (Müller, 2020: 69).

2.2. The perception component

The notion of IPVs also excludes pure mental verbs like *denken* ‘think’ or *schlussfolgern* ‘infer’ in (6) with a propositional complement but lacking a perception component:

- (6) a. Margarete dachte / schlussfolgerte, dass Marie den König umgebracht hat.
Margret thought / inferred that Mary the king killed has
b. §An der offenen Tür dachte / schlussfolgerte Marie, dass John zuhause war.
at the open door thought / inferred Mary that John home was

Propositions are non-physical, abstract entities which cannot be perceived because they are not bound in space and time; they are “timeless and placeless” (Gisborne, 2010: 120). *An*PPs in the context of mental verbs like in (6b) are restricted to a spatiotemporal reading such that the

⁴These include events and Davidsonian states, but not Kimian states, see Maienborn (2019).

anPP is understood as a frame-setting locative.⁵ This triggers a temporal reading that can be paraphrased as ‘When Marie was at the door, she thought/inferred that John was home’ (cf. Maienborn, 2001: 196f.). *Belief*-predicates are not compatible with evidential *anPP*s. They are disqualified as IPVs because of their lack of a perception component.

At this point it is worth to note that *anPP*s in the context of IPVs are not restricted to an evidential interpretation. A regular locative *anPP* similar to (6b) is always possible. This is not contradictory, as (7) shows.

- (7) An der Treppe sah Marie an der offenen Tür, dass John zuhause war.
at the stairs saw Mary at the open door that John home was

Here, the first *anPP* exhibits a spatiotemporal reading, while the second one is evidential. Section 3 will return to this point. In the remainder of this paper it will become clear that the two readings of the *anPP*s in (7) result from different syntactic positions.

2.3. The group of inferential perception verbs

The distribution of evidential *an* permits generalizations on the event structure of the embedding predicates. Based on the observations above, Müller (2020) argues for a uniform lexical analysis of PVs in their direct use and in their inferential use, in that both involve a regular stimulus argument. In the direct reading of PVs, the stimulus is syntactically realized as direct object of the verb, while in the inferential reading, it may be realized by an *anPP*. Verbs that are compatible with evidential *anPP*s embed inferential propositions as complements and crucially involve an implicit perception argument. The access to a perception stimulus is a key factor to the notion of evidentiality for the phenomenon investigated here: it is acknowledged that the most direct evidence is that of perception as a first-hand experience. The two most prominent sensory modalities that serve evidential functions are that of visual and auditory perception (Whitt, 2010). This is reflected in the frequency of the verbs modified by evidential *anPP*s.

Evidential *anPP*s occur not only with PVs in their inferential reading, but also with the two rather cognitive verbs *merken* ‘notice’, ‘realize’ and *erkennen* ‘recognize’. Both impose stricter constraints on the selection of complement types than PVs. Neither *merken* nor *erkennen* licenses complements in accusative with infinitive construction, and the selection of nominal complements is highly restricted for *merken*. On the other hand, *erkennen* has less restrictions on the combination of nominal complements and evidential *anPP*s than PVs and *merken*.⁶ These observations conflict with the classification of *merken* and *erkennen* as PVs, cf. (3), and corroborates instead the classification of IPVs. The following verbs constitute the group of IPVs:

- PVs in their inferential use: *sehen* ‘see’, *hören* ‘hear’, and with less frequency *spüren* ‘feel’, *riechen* ‘smell’, *schmecken* ‘taste’; see (8)–(12)

⁵The judgment § indicates that the intended reading is not available.

⁶See (i) for an object-denoting NP combined with an evidential *anPP* with *erkennen*. PVs as well as *merken* restrict this combination to NPs referring to tropes like in (12).

(i) Marie erkennt / *merkt das Kind am Klang seiner Stimme.
Mary recognizes / notices the child at.the tone of.its voice

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- Inferential verbs implying perception without specification of the sensory channel: *merken* ‘notice’, ‘realize’ and *erkennen* ‘recognize’; see (13)–(14)
- (8) Dass der Anbau von Soja für die burgenländischen Landwirte immer mehr an Bedeutung gewinnt, sieht man schon alleine an der Anbaufläche. [Burgenländische Volkszeitung, 19.08.2010]
‘That soybean cultivation is becoming increasingly important for farmers in Burgenland can be seen from the area under cultivation alone.’
- (9) An ihrem Englisch – an der Betonung, an der Wortwahl und an den Flüchen – hört man sofort, dass sie nicht zur feinen Oberschicht gehören. [Die Südostschweiz, 14.09.2010]
‘From their English – the accent, the choice of words and the swearing – you can immediately hear that they do not belong to the upper class.’
- (10) Und dass das Team der Bücherei mit seiner Entscheidung richtig lag, das spürte man an den Gesprächen mit den Eltern und den Kindern. [Rhein-Zeitung, 22.09.2011]
‘That the library team was right in its decision can be felt in the conversations with parents and children.’
- (11) Sie riecht an ihrem Liebhaber, dass er sie betrogen hat. [Braunschweiger Zeitung, 19.04.2010]
‘She smells on her lover that he has betrayed her.’
- (12) Gäste des Hauses wissen, dass man die Freude, die die Köchin an der Arbeit hat, an den Speisen schmecken kann. [Niederösterreichische Nachrichten, 06.02.2014]
‘The guests know that you can taste the joy that the chef has in her work in her dishes.’
- (13) Wir merken an der regen Nachfrage nach WM-Artikeln, dass alle auf das Turnier warten. [Mannheimer Morgen, 10.06.2014]
‘We can notice from the brisk demand for World Cup merchandise that everyone is waiting for the tournament.’
- (14) Auch die Kleinsten sind bereits dabei – und an ihrem blau umrandeten Mund erkennt man, dass auch sie die Kirschen mögen. [St. Galler Tagblatt, 07.07.2010]
‘Even the little ones are already involved – one can recognize by their blue-rimmed mouths that they also like the cherries.’

2.4. Decomposition of inferential perception verbs

IPVs belong to the group of subject-experiencer verbs similar to PVs. They select a subject argument with the thematic role of an experiencer that non-volitionally perceives an independently existing entity, that is, a stimulus; see e.g. Dowty (1991). The stimulus evokes a change of mental state in the experiencer.⁷ Crucially, I want to argue that an implicit perception stimulus acts as causer of a mental state of the experiencer. The content of the evoked mental state is the embedded proposition. There is an ongoing debate on the view that stimuli are causers

⁷Müller (2020) points out with help of a context where Holmes and Watson perceive the same stimulus, but only Holmes draws a conclusion from it, that inferences are not solely due to the stimulus, but depend on the experiencer’s previous knowledge. It is a crucial fact that inferences involve prior knowledge and thus a kind of abductive reasoning by the experiencer. Since this paper focuses on the lexical contribution of *an*PPs, I do not go into details here.

of mental states in the experiencer. This is mainly discussed for psych verbs like *admire* or *surprise*, cf. Dowty (1991); Pesetsky (1995); Rapp (1997); Primus (2012). More recent studies by Bott and Solstad (2014) show that sentences like (15) trigger the search for an explanation of John’s attitude towards Mary. Notably, causing factors are more often ascribed to the stimulus (Mary) than to the experiencer (John) in their experimental studies.

(15) John admires Mary.

The conceptual availability of a causal relation between the stimulus und the mental state of the experiencer seems to be quite substantial for IPVs. The cancellation of an implicit perception stimulus leads to a contradiction. (16) provides strong evidence that a stimulus is presupposed:

(16) #Kim merkte, dass Herbst war, aber es gab nichts, woran sie es merkte.
Kim noticed that autumn was but there was nothing where.at she it noticed

Sensory perception is always factive (but see Higginbotham (1983) for a deeper discussion of veridicality constraints). The experiencer’s mental state with the embedded proposition as its content is thus justified by factive perception. That IPVs are typically veridical and factive by presupposing the truth of the embedded proposition (Müller, 2020), may result from causally linked factive perception. In this work I therefore propose a lexical approach in positing a semantically implicit causal relation in the event structure of IPVs as given in (17).⁸ The lexical entry (17) is based on the above observations. Here, I focus on the denotation of *merken*. Yet, the event structure in (17) should remain the same within the group of IPVs, besides the verb-specific meaning component marked with’.⁹

(17) $\llbracket \text{merken} \rrbracket = \lambda p \lambda x \lambda e \exists s \exists c [\text{merken}'(e) \ \& \ \text{experiencer}(e,x) \ \& \ \text{stimulus}(e,c) \ \& \ \text{cause}(c,s) \ \& \ \text{belief}(s) \ \& \ \text{experiencer}(s,x) \ \& \ \text{content}(s,p)]$

As shown in (17), *merken* denotes an event that involves an experiencer *x* as subject referent, a stimulus *c* that causes a belief state *s* of experiencer *x* with proposition *p* as content. The stimulus *c* is presupposed and therefore existentially bound. It is thus not grammatically available, but only on a conceptual level. Instead, only the content *p* of the belief-state is lambda-bound and grammatically available. In other words, *merken* involves a kind of split of two conceptually involved arguments – one stimulus argument, and one propositional argument – in that only the latter is available on the surface structure. The stimulus argument may be syntactically realized by an *anPP*. The next section first focuses on the basic lexical meaning of *an* and then provides a compositional tool to link the *anPP* to the implicit stimulus argument.

3. Lexical meaning contribution of *an*

The preposition *an* is highly polysemous. Most prominently, *an* expresses relations of spatial proximity (18a) and of physical contact (18b), and is suitable for the expression of part-whole-relations (18c). Note that any part-whole-relation entails contact, and any contact relation entails proximity.

⁸Other authors argue against a lexically involved causal relation for psych verbs like *admire*, f.i. Härtl (2008) who takes it as a conversational implicature. If a pragmatic approach to the causal interpretation is reasonable in the context of IPVs, is deferred for future work. Here, I propose a lexical analysis.

⁹Thus, $\llbracket \text{schmecken} \rrbracket$ should contain the verb-specific meaning component *schmecken'* and restrict the implicit perception stimulus to a taste-object.

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- (18) a. Der Stuhl steht an der Bar.
the chair stands at the bar
b. Das Bild hängt an der Wand.
the picture hangs at the wall
c. Der Daumen ist an der Hand.
the thumb is at the hand

Prevalent transferred uses of *an* apply to temporal relations like *an diesem Montag* ‘at this monday’ which are derived from a spatial meaning via time-is-space metaphors, as well as to cognitive proximity like *Das Kind hängt an seinen Eltern* ‘The child is (emotionally) dependant on its parents’. Furthermore, *an* frequently triggers a causal interpretation in the context of experiencer verbs, like in (19).

- (19) John leidet an einer Krankheit.
John suffers at a disease

For a recent overview on the relations expressed with *an*, see Kiss et al. (2020). The evidential reading of *an* is rarely mentioned in the relevant literature, but see Blatz (1896: 456) who refers to it with the term ‘Erkenntnisgrund’ (“reason of inference”), as well as Müller (2020) and Diewald and Smirnova (2010). However, the spatial locative reading as in (18) is commonly regarded as the primary basic meaning. As I will show below, work on the spatial meaning of *an*, in particular the work of Klein (1991) and Carstensen (2000; 2015) form indeed a solid basis to derive its evidential reading.

3.1. The locative reading

Following standard theory, Klein (1991) takes prepositions as two-place functions. In his region-based account, a locative preposition maps the location of a theme (the localized entity) to the preposition-specific region of the relatum (the reference object). For *an*, he proposes a physical contact relation as abstract basic meaning. The localized entity is located in the *an*-region of the reference object, if the location of the localized entity is adjacent to the location of the reference object. A major evidence for this approach is that *an* is the obligatory locative preposition for contact verbs like *lehnen* ‘to lean’, or *hängen* ‘to hang’ in (18b).

Carstensen (2000; 2015) departs from a pure spatial account and seizes instead the role of cognitive attention expressed with prepositions. His cognitivist approach is based on the assumption that the detection of a suitable reference object involves a certain conceptualization of it, like a visuo-spatial referent that is associated with the reference object. Spatial *an* implies the categorization of the *an*-internal referent as ‘boundary’ (Carstensen, 2015: 115); that is, the reference object of *an* is not conceptualized holistically, but involves an attentional shift to its surface structure. This view explains the obligatory use of *an* for contact relations and with reference objects denoting boundaries like *am Strand* ‘at the beach’. The author points out that the boundary of an object constitutes a part of the object, such that *an* is more specifically suitable to express part-whole-relations like in (18c). Laptieva (2022) formalizes Carstensen’s approach in proposing the lexical entry (20) for *an*. She argues that the denotation in (20) fits best to the range of spatial constellations possibly expressed by *an*, as it may account for relations of parts to their wholes, of physical contact, and of spatial proximity as in (18).

(20) $\lambda y \lambda x [\text{loc}(x, \text{boundary}(y))]$ (Laptieva, 2022: 157, (159))

While proximity and physical contact depend on the spatial adjacency of the localized entity to the boundary of the reference object, a part-whole-relation holds in case the localized entity is a proper part (of the boundary) of the reference object. As will be shown in Sections 5 and 6, evidential *an* exploits this most specific part-whole-relation. The preferred reading of (1b), repeated in (21a), is such that Mary perceives certain properties of the door that cause her inference. The stimulus is thus a particularized property that constitutes a part of the door. Evidential *an* relates the stimulus involved in an IPV-event to its reference object. If the reference object is concrete, the stimulus is located on its surface, that is, its boundary. This is what makes the stimulus perceivable and essential for the cognitive discernment of objects. The attentional shift to a part of the *an*-internal referent plays an essential role for the qualification as suitable information source. Grammatically, the reference object of evidential *an*PPs may be underspecified with regard to their contextually salient part.

The less specific proximity relation is only suitable in a non-evidential reading as in (21b). Here, no perception stimulus is overtly realized. Instead, the described event, or Mary in the moment of inferring, is situated in spatial proximity of the open door. In this spatiotemporal or locative reading, *an* is replaceable with *bei* ‘near’, ‘next to’. As Carstensen: 115 argues, *bei* is only compatible with a holistic conceptualization of the reference object. It follows that the *an*PP in (21b) comes up with a conceptualization of the boundary of the door as a ‘holistic location’, whereas *bei* is ruled out in the evidential reading (21a).

- (21) a. An / **bei* der offenen Tür merkte Marie, dass John zuhause war.
 ‘From the open door, Mary noticed that John was home.’
 b. An / *bei* der offenen Tür merkte Marie, dass John zuhause war.
 ‘Mary noticed that John was home when she was near the open door.’

Whether the *an*PPs is locative or evidential depends further on the entity it relates to its reference object. I argue that in (21a), the *an*PP relates an event participant – the stimulus – to the reference object, whereas in (21b), it relates the event referent to the reference object. In the remainder of this section I will therefore propose an analysis of evidential *an*PPs as event-internal modifiers. This permits the *an*PP to access event participants. The general idea is that they introduce a spatial relation that holds within the event such that the implicit stimulus is related to the reference object of *an*.

3.2. Event-internal modification

The following approach is based on Maienborn’s (1996; 2001) analysis on the syntax and semantics of local adjuncts. She argues for different syntactic base positions of lexically unaltered locative PPs, that result in different compositional meaning contributions. Adjuncts on the V-level of the VP are what Maienborn calls event-internal modifiers. It follows from this verbadjacent position that the meaning of the adjunct relates to the internal structure of the event denoted by the VP (Maienborn, 1996: 145). Event-internal modifiers do not target the event referent as a ‘whole’. Instead, they modify an integral part of the event, that is, an entity that serves some function within the event (Maienborn, 2001, 2003). The relevant part of the

event is determined on a conceptual level and need not be overtly lexicalized (Maienborn, 2001: 218f.). In contrast, event-external modifiers relate to the event referent and trigger a holistic perspective on the event referent. Syntactically, they are adjuncts on the VP-level.

Maienborn's (1996) example (22) shall serve as a sample of an event-internal *an*PP that locates an integral part of the described event to its reference object. Maienborn bases her analysis mainly on Klein's (1991) approach to the lexical meaning of *an* denoting a physical contact relation of the localized entity to the reference object.

- (22) Paul zieht Maria an den Haaren. (Maienborn, 1996: 236, (43a))
Paul pulls Mary at the hairs

According to Maienborn, an integral part of Paul's pulling event is located at and in contact to Mary's hair. At this stage of linguistic processing, conceptual knowledge comes into play. As Maienborn points out, it belongs to our conceptual knowledge that humans perform pulling events stereotypically by using their hand(s). This, in addition to the conceptual knowledge that hands are parts of humans and, in (22), of Paul, leads to the intended interpretation that a part of the described event in (22), namely Paul's hand(s) as (instrument) participants of the pulling event, is located on Mary's hair. In this respect, the locative meaning of the event-internal *an*PP may be augmented by an instrumental or manner reading, depending on the particular functional embedding (Maienborn, 1996; 2001).

In the following example from Laptieva (2022), an *an*PP modifies the detransitivized incremental predicate *malen* 'paint' and triggers an atelic interpretation of the described event.

- (23) Mia malt an einem Bild. (Laptieva, 2022: 172, (192))
Mia paints at a picture

Laptieva shows that the incremental and thus atelic reading of (23) follows a) from the meaning of *an* along the lines of Carstensen as given in (20), and b) from the verbadjacent position of the *an*PP such that it acts as an event-internal modifier. Crucially, the *an*PP modifies the painting event in such a way that a subpart of painting – f.i. a stroke of the brush which is the incremental theme of the event – is conceptualized as boundary and part of the picture. Here again, an implicit participant of the painting event is conceptually inferred.

The fact that the *an*PP has access to the verb's internal event structure and realizes an implicit participant argument, can be proven with appropriate interrogatives. In German, the interrogative *Wo?* is used for the reference to locations and thus compatible with event-external PPs, see the questioning of the external locative *am Strand* 'at the beach' in (24a). On the contrary, the interrogatives *Woran/worin/worauf/womit* (literally 'where-at', 'where-in', 'where-on', 'where-with') etc. are not suitable for the reference to locations of events. Instead, their theme argument is restricted to objects (Maienborn, 2003: 483). Those interrogatives are only suitable to event-internal entities, like participants, instruments, or other object-like entities. To question the atelic *an*PP in (23), the use of *Woran?* is required, see (24b).

- (24) Mia malt am Strand an einem Bild.
Mia paints at.the beach at a picture
 a. A: Wo malt Mia?
 B: Am Strand. / §An einem Bild.

- b. A: Woran malt Mia?
 B: §Am Strand. / An einem Bild.

Evidential *anPPs* are only compatible with the interrogative *Woran?*, cf. also (16). While (21a) requires the *woran*-interrogative, (21b) requires the *wo*-interrogative. This observation shall give further evidence for the current approach to evidential *anPPs*.

A formal template for modification as proposed by Maienborn (2001; 2003) and refined in Bücking (2018) is provided in (25). According to that, a modifier introduces a free variable v that links the modifier's external argument x to the modifier's referent via a relation R . The notation $\lambda P \lambda \vec{y}$ means that nonsaturated arguments of P will be forwarded to the modifier.

- (25) MOD* template: (Bücking, 2018: (84))
 a. $\lambda Q \lambda P \lambda \vec{y} \lambda x [P(\vec{y})(x) \wedge R(x, v) \wedge Q(v)]$
 b. Condition on the application of MOD*: If MOD* is applied in a structural environment of categorial type X^0 , then $R = \mathbf{internal-component}$ (that is, $R = \mathbf{part, manner}$ or \mathbf{degree}); if it is applied in an XP-environment, then $R = \mathbf{identity}$.

In case of event modification, $x = e$. According to condition (25b), R is of type *int(ernal-component)* if the modifier is a V-adjunct. That is, R pairs the event denoted by the verb to one of its internal components. Importantly, the specific value of $R(e, v)$ is not instantiated in this case and thus underspecified for event-internal modifiers: “The identification of v and its exact role in e can only be spelled out [...] by taking into account contextually available world knowledge.” (Lang and Maienborn, 2019: 136)

I argue that the evidential reading of *anPPs* arises in case they are V-adjuncts of IPVs.¹⁰ In this sense, evidential *anPPs* act as event-internal modifiers of IPVs. The implicit perception stimulus provided in the event structure of IPVs instantiates an internal component v of e and constitutes a proper part of the observable surface of the *an*-referent. Thus, the boundary-relation contributed by *an* is of the most specific part-whole type. This approach provides a uniform lexical meaning of *anPPs*.¹¹ In the next section, I will give a detailed analysis of the composition of event-internal *anPPs* with IPVs, and elaborate on the conceptual specification of underspecified meaning components.

¹⁰Evidence for a verbadjacent base position, that is, a position between the direct object and the verb, is provided by (i). Only a whole constituent may be moved into the prefield. The acceptability of (ia) attests that the locative *beiPP* is external, while the evidential *anPP* in (ib) is not. A structure as in (ii) is not possible because t_i is not c-commanded by its antecedent. This speaks for a position of the *anPP* below the direct object.

- (i) a. Es gemerkt hat sie bei der Treppe.
 b. *Es gemerkt hat sie an den Blättern.
 (ii) *[Es t_i gemerkt] $_j$ hat sie [an den Blättern] $_i t_j$.

¹¹Note that event-external locative *anPPs* are also captured by MOD* and the boundary-relation of *an*. In this case, the PP is applied on the VP-level, such that R is the identity function and e is related to the reference object (which is conceptualized as boundary). Since e is not a proper part of the reference object of *an*, the boundary-relation is less specific and of proximity-type. The *anPPs* in (6b)/(21b) locate e in the spatial proximity of the *an*-referent.

4. Compositional analysis of evidential *an*

To implement the conceptual instantiation of underspecified components in a formal theory, I make use of the framework of Two-level semantics as presented in Lang and Maienborn (2019). The interpretation of a linguistic expression is two-fold: The Semantic Form (SF) is strictly compositionally derived and based on the lexical meaning of the involved expressions. On this level, underspecified meaning components will not be instantiated and remain underspecified. The Conceptual Structure (CS) is the level of representation that involves pragmatic enrichment. On the basis of the knowledge provided by the conceptual system, underspecified meaning components will be instantiated.

4.1. Composition to Semantic Form

As example shall serve (1a), repeated as (26). Composition is based on the lexical entries of *merken* in (17) and of *an* in (20), each repeated in (27) and (28), as well as on MOD* in (25). Underspecified components are encoded as free variables and are highlighted in bold below.

(26) Kim merkte **an** den Blättern, dass Herbst ist.

(27) $\llbracket \text{merken} \rrbracket = \lambda p \lambda x \lambda e \exists s \exists c [\text{merken}'(e) \ \& \ \text{experiencer}(e,x) \ \& \ \text{stimulus}(e,c) \ \& \ \text{cause}(c,s) \ \& \ \text{belief}(s) \ \& \ \text{experiencer}(s,x) \ \& \ \text{content}(s,p)]$

(28) $\llbracket \text{an} \rrbracket = \lambda y \lambda x [\text{loc}(x, \text{boundary}(y))]$

The application of MOD* to the PP *an den Blättern* yields (29).

(29) $\llbracket \text{an den Blättern} \rrbracket = \lambda P \lambda \vec{y} \lambda x [P(\vec{y})(x) \ \& \ R(x, \mathbf{v}) \ \& \ \text{loc}(\mathbf{v}, \text{boundary}(\text{def-leaves}))]$

Functional application of *merken* to the modifier *an den Blättern* yields (30). The arguments of *merken* are forwarded to the PP. According to condition (25b), *R* is specified as *int(ernal component)* because it is applied inside the V-projection.

(30) $\llbracket \text{an den Blättern merken} \rrbracket = \lambda p \lambda x \lambda e \exists s \exists c [\text{merken}'(e) \ \& \ \text{experiencer}(e,x) \ \& \ \text{stimulus}(e,c) \ \& \ \text{cause}(c,s) \ \& \ \text{belief}'(s) \ \& \ \text{experiencer}(s,x) \ \& \ \text{content}(s,p) \ \& \ \mathbf{R}_{int}(e,\mathbf{v}) \ \& \ \text{loc}(\mathbf{v}, \text{boundary}(\text{def-leaves}))]$

Application of the propositional complement *dass Herbst ist*, followed by introduction of the subject and existential closure of the event variable lead to the Semantic Form of (26) in (31).

(31) $\llbracket \text{Kim merkt an den Blättern, dass Herbst ist} \rrbracket = \exists e \exists s \exists c [\text{merken}'(e) \ \& \ \text{experiencer}(e,K) \ \& \ \text{stimulus}(e,c) \ \& \ \text{cause}(c,s) \ \& \ \text{belief}'(s) \ \& \ \text{experiencer}(s,K) \ \& \ \text{content}(s, \text{'it is autumn'}) \ \& \ \mathbf{R}_{int}(e,\mathbf{v}) \ \& \ \text{loc}(\mathbf{v}, \text{boundary}(\text{def-leaves}))]$ (SF)

(31) says that Kim is experiencer in an event *e* such that a stimulus *c* causes her belief state *s* that has the proposition ‘it is autumn’ as content, and that some internal component *v* of *e* is located at the boundary of the leaves. At this point, semantic composition stops. The instantiation of *R_{int}(e,v)* has to be passed to the conceptual system which makes use of contextual and conceptual knowledge about *merk*-events, autumn and leaves.

4.2. Conceptual specification of underspecified variables

On the conceptual level, underspecified SF-components are pragmatically or conceptually enriched. Principally, their instantiation with a linguistically provided referent is preferred: “A free variable x is instantiated preferentially by a referent that is introduced by linguistic means, always provided that it meets the conditions on x ” (Maienborn, 2003: 496). The condition on R_{int} states that v is an internal component of e . Since *merken* involves a stimulus c as participant that is provided conceptually (c is bound existentially, but not via lambda), c constitutes an internal component of the event e :

$$(32) \quad \forall ec [\text{stimulus}(e,c) \rightarrow \text{internal-component}(e,c)]$$

The stimulus is a suitable candidate for $R_{int}(e,v)$ and instantiates it in an economical way. Formally, $R_{int}(e,v)$ is identified with $\text{stimulus}(e,c)$, yielding the conceptual structure in (33):

$$(33) \quad \text{Kim merkt an den Blättern, dass Herbst ist:} \quad (\text{CS}) \\ \exists e \exists s \exists c [\text{merken}'(e) \ \& \ \text{experiencer}(e,K) \ \& \ \mathbf{\text{stimulus}(e,c)} \ \& \ \text{cause}(c,s) \ \& \ \text{belief}'(s) \ \& \\ \text{experiencer}(s,K) \ \& \ \text{content}(s, \text{'it is autumn'}) \ \& \ \text{loc}(c, \text{boundary}(\text{def-leaves}))]$$

(33) in prose: Kim is experiencer in an event e such that a stimulus c causes her belief state s that has the proposition ‘it is autumn’ as content, and c is located at the boundary of the leaves. The conceptual structure in (33) predicts that the stimulus c , that is causer of the mental state, is located and thus perceived on the boundary of the *an*-referent, but not fully specified. This is attested by results of a corpus study that show that the reference objects of evidential *an*PPs are underspecified and interpreted as bearers of tropes (see Section 5). A trope is a particularized property that is perceivable and causally efficacious, and manifests in its bearer – and thus is part of its bearer (Moltmann, 2013; Maienborn and Herdtfelder, 2017; Campbell, 1981). Inferences are therefore not based on the perception of the whole entity the *an*PP refers to, but on the perception of particular aspects of this entity that are observable. In example (33), the stimulus c may be the specific coloredness of the leaves. Notably, this meets the general idea of Carstensen’s cognitive attentional semantics of *an*.

The evidential reading of *an* arises because the underspecified relation R_{int} , introduced by the modifier, is conceptually instantiated by an indirect causal relation between the inferring event and the *an*-referent. That is why the content of *an*PP qualifies as ‘information source’ to the inference drawn by the subject.

5. Corpus study on ontological features of *an*PPs

Grammatically, an evidential *an*PP is the anchor of an implicit stimulus argument in the embedding verb and relates it to the boundary of the reference object. But, what about the ontology of information sources? I want to shed light on this question and present results of a corpus study that will round up the picture drawn on *an* and emphasize why specifically the preposition *an* is used for evidential information sources.

5.1. Idea and setup

In order to get an idea about the ontological nature of information sources in IPV_s, I conducted a corpus study in the context of *merken* in DeReKo.¹² In 932 records, *merken* is modified by an *an*PP. Under exclusion of *an*PPs with vague head nouns like *Ding(e)* ‘thing(s)’, *Punkt(e)* or *Stelle(n)* ‘point(s)’, *Detail(s)* ‘detail(s)’, and the like, the first 300 records were investigated. In a first step, the sortal types of the *an*-internal head nouns were annotated along the lines of annotation criteria developed by Metzger et al. (2019). A second step addressed the ontological type of the stimulus itself. A suitable tool to grasp the ‘conceptual’ meaning components of evidential *an*PPs consists in paraphrasing them. To preserve the contextual/conceptual appropriate interpretation, attributes to the *an*-internal head were considered in this step.

5.2. Quantitative results

Out of 300, the vast majority of 240 records involves *an*PPs in the evidential reading. Of the remaining 60, 44 records exhibit a locative reading such that the described event is situated in space or time. In all of these cases, the head noun contextually refers to a landmark, or to a path section or time section at which the *merken*-event takes place. In these cases, the *an*PP can be questioned with *Wo?* and replaced with phrases headed with *bei* or *während* ‘during’. In the remaining 16 cases, it is not decidable if *an* is used in a locative sense or a non-locative sense. Hence, in sum 60 records were expelled for the further inquiry about the ontological nature of information sources. The annotation of the sortal type of the head noun in accordance to the given criteria turned out to be tricky and in particular cases hardly possible. Nevertheless, the first step does not reveal any strict sortal type restrictions on the head noun of evidential *an*. Reference to any ontological type is represented. Even though the numbers below should be taken into account with care, a strong tendency to head nouns referring to tropes and to eventualities is observable: 26% of all head nouns refer to tropes¹³ and about 23% to eventualities. This is followed by reference to animate objects including body parts, and to abstract categories with both about 14%; 8% refer to content objects; 5,4% to inanimate concrete objects; a minimal rest to domains. About 6% of head nouns were ambiguous in their reference to eventualities or to objects as results of an event and annotated as such. A quantitative summary in absolute numbers for both readings is given in Table 1. Table 2 provides typical examples of the categories that occur in the evidential reading of *an*.

¹²Deutsches Referenzkorpus, DeReKo-2014-I, archive TAGGED-T2-öffentlich, using CosmasII, search was done via the search key “(&merken /0s,Max (an %+1w,Max (, or (; or (. or :))))”. The exclusion of interpunction marks intended to exclude occurrences of *an* as verb particle; yet a manual selection of relevant records in the *merken+an*PP-construction was inevitable.

¹³The category of tropes comprises not only those entities to which NPs like *Johns Angespanntheit* ‘John’s edginess’ refer to, but also so-called number tropes, that refer to a particular number of elements of a sum. Moltmann (2009; 2016) speaks of instantiations of the ‘property of being so-and-so many’.

reading \ head	sum	Institution	Temporal Relation	Spatial Relation	Inanimate Object	Eventuality	Trope	Animate/ BodyPart	Abstract Category	Content Object	Event/ Result	Domain
locative	44	7	22	3	7	5	0	0	0	0	0	0
evidential	240	0	2	1	13	58	63	33	33	20	15	2
sum	284	7	24	4	20	63	63	33	33	20	15	2

Table 1: Ontological types of *an*-internal head nouns ordered by reading

Ontological category	Example noun	Translation
TROPE:	<i>Angespanntheit, Anzahl</i>	edginess, number
EVENTUALITY:	<i>Reaktion(en), Verkäufe</i>	reaction(s), sales
ANIMATE/BODY PART:	<i>Besucher, Augen</i>	attendees, eyes
ABSTRACT CATEGORY:	<i>Gewohnheiten, Namen</i>	habits, names
CONTENT OBJECT:	<i>Mail(s), Text(e)</i>	mail(s), text(s)
INANIMATE OBJECT:	<i>Wein(e), Geschenk(e)</i>	wine(s), gift(s)
EVENT/RESULT:	<i>Rückmeldung(en), Vortrag</i>	feedback, lecture
DOMAIN:	<i>Politik (2x)</i>	politics (2x)

Table 2: Typical head nouns in the evidential reading ordered by frequency

5.3. Qualitative results and discussion

The second step of the study intends to identify the ontological status of the stimulus. It is based on the compositional prediction that the reference objects of evidential *an*PPs are underspecified with respect to the actual perception stimulus (see Section 4). The salient stimulus has to be conceptually inferred, preferentially by exploiting linguistically given referents (cf. to Maienborn's (2003) principle on the preferred instantiation of underspecified meaning components cited above). This motivates the consideration of attributes to the head nouns to grasp the intended interpretation of evidential *an*PPs, if present. It turns out that, independently of the presence of attributes, more than 95% of all evidential *an*PPs are paraphrasable with terms like *an der Art von* 'at the kind/manner of', *an der Anzahl von* 'at the number of', *an der Höhe von* 'at the extent of', *am Grad von* 'at the degree of', *am Geschmack/Klang/Aussehen von* 'at the taste/sound/look of', and the like. Crucially, expressions of this sort describe tropes. Generally, tropes are the kind of entities adjectives and definite deadjectival nominalizations refer to (Moltmann, 2009, 2013). Evidential *an*PPs generally imply reference to tropes. The point shall be made clear with example (34), involving an eventive nominal as reference object of *an*.

- (34) Und ich erinnere mich noch, wie eines Tages der Briefträger zu meiner
and I remember REFL still how one day the postman to my
 Oma in den Garten kam. An seinem zögernden Schritt merkte ich, dass er
grandmother in the garden came. at his hesitant step noticed I that he
 schlechte Nachrichten brachte. Einer meiner drei Onkel war gefallen.
bad news brought. one.of my three uncles has fallen

[Die Zeit (Online-Ausgabe), 01.07.2010]

In (34), it is surely not the holistic event of the postman's stepping that causes the speaker's inference. Instead, the information source for the inference is based in the particular manner

in which the event is realized. This can be paraphrased as *how the postman realizes his steps* or simply *the manner of his steps* (see e.g. Moltmann (2009) for the trope-related reading of *how*-sentences). This holds respectively for the *an*PPs in the context of IPVs given in Section 1. In (8), it is the particular size of the soy cultivation area that gives evidence for its increasing importance. In (9), it is the particular kind of intonation, diction and cussing that causes the belief that the persons do not belong to the upper class. It is worth to emphasize that the specific kind of information source is determined by the ontological type of the reference object. *An*PPs referring to physical objects may be paraphrased by expressions referring f.i. to shape, colour, taste, age, or volume if it is a sound object. Suitable paraphrases for *an*PPs referring to eventualities refer f.i. to manner or duration. *An*PPs referring to pluralities are paraphrased with the expressions *number of* or *amount of*. Trope-referring *an*PPs allow paraphrases referring to the extent or degree of the manifestation of a property, or the tropes they refer to constitute the relevant information source by themselves.

A main result of the corpus study is that the reference objects of evidential *an*PPs are not conceptualized ‘as a whole’. The relevant information source for a further inference is a particularized property – a trope – that is manifested in the referent. In other words, evidential *an*PPs are underspecified and refer to bearers of tropes. The contextually salient trope is inferred from its bearer by exploiting contextual and conceptual knowledge. That tropes are best identified through their bearers has already been commented by Maienborn and Herdtfelder (2017: 289). Crucially, I claim that the implicit perception stimulus involved in IPVs is of type TROPE and constitutes an internal aspect of its bearer.¹⁴ In the next section, the discussion of tropes as relevant information sources will complete the observations on evidential *an*.

6. Tropes as information sources

Tropes are dependent on their bearers and are thus conceptualized as parts of their bearers. The attentional focus to a part of the reference object thus meets Carstensen’s analysis of locative *an*. The partitive conceptualization rules out the use of *bei* to refer to information sources, cf. (21a)/(21b). That the relevant stimulus is restricted to be a proper part of the *an*-referent can be shown by stipulating a specific context for (1a), repeated below as (35). Suppose, it is not the colour of the leaves that causes Kim’s inference that it is autumn, but the amount of leaves she perceives on the ground. Then it would still be felicitous to utter (35a), because the specific amount is a particular number trope that manifests in the sum individual consisting of the leaves. But it is not suitable to describe this situation by (35b), because the amount-trope of the leaves is not part of the ground.

- (35) a. Kim merkte an den Blättern, dass Herbst war.
Kim noticed at the leaves that autumn was

¹⁴The relevant trope may, but most not, overtly realized by an adjectival modifier inside the *an*PP. From the speaker’s perspective, the linguistic realization of an adjective is motivated by the intention to assure that the hearer appropriately identifies the underspecified stimulus *c*. According to Maienborn’s (2003) principle on the instantiation of underspecified meaning components, the modified *an*PP *an den roten Blättern* ‘at the red leaves’ would augment the CS (33) with a specification of *c* as in (i):

(i) stimulus(*e,c*) & loc(*c*,boundary(def-red-leaves)) & red(*c*)

- b. §Kim merkte am Boden, dass Herbst war.
Kim noticed at.the ground that autumn was

Further, tropes are perceivable because they are concrete entities in the world. Notably, they realize a particular quality or instantiation of properties which define the different ontological types of entities. As Kaufmann (1995) points out, different kinds of entities are defined with regard to the property dimensions they always display. Concrete physical objects are thus defined by displaying spatial properties like shape or size, visual properties like colour, material properties like substance, and so forth, and “any change affecting a specific object defining property may only lead to another quality (or ‘instantiation’) of this property” (Kaufmann, 1995: 380). What Kaufmann calls ‘object defining properties’ are the specific properties to which the paraphrases used in the corpus study refer. Thus, inferences are based on an attentional shift to certain quality manifestations of an entity, and do not only involve the cognitive detection of entities as such, but the detection of altering quality manifestations in these entities. Information sources thus always imply comparison to former experiences of the same or similar entities. The latter point is crucial for the causing character of the stimulus. I want to make the point clear with the help of (34). Notably, the specific realization of the postman’s steps obviously deviates from his standard steps. What happens in the experiencer’s mind is the assumption that the postman has a reason to walk in a non-standard, hesitant manner. The perception of the deviation of the standard quality of his steps triggers the search for an explanation, thus, causes the experiencer’s inference. Note that Kaufmann’s object defining properties constitute the perceivable boundaries of concrete entities. Trope perception thus entails the perception of its bearer. Conversely, we cannot perceive a concrete physical object without perceiving its shape, colour, or size. Neither can we perceive an eventuality without recognizing its specific manner of realization. Tropes not only constitute parts of the respective entities, but also are perceivable on their ‘surface structure’ and are in physical contact to its bearer. The use of *an* thus follows straightforwardly from its basic locative meaning. Nevertheless, as the results of the corpus study show, evidential *an* also allows for more abstract referents. How could habits be directly perceived, since they are only observable during a longer time period and hence are ruled out for direct sensory perception? Similarly, a continuously increasing number of patients like in (36) is surely no possible object of direct perception and on the first sight runs contra the claim that evidential *an*PPs refer to directly perceived entities.

- (36) “An der kontinuierlich steigenden Patientenzahl merken wir, dass unser
at the continously increasing number.of.patients notice we that our
 Pflegekonzept angenommen wird”, freut sich die Geschäftsführerin.
care.concept embraced is, pleases REFL the director

[Braunschweiger Zeitung, 17.04.2013]

According to Whitt (2010), those cases nonetheless involve perceived entities. Several perception stimuli are merged into a set of data from which tendencies and behaviours are derived. In (36), the perception data set comprises a sequence of variable number tropes manifested in its bearer, a variable sum of patients. The distinction between direct sensory perception and more abstract observation seems not to be reflected in evidential *an*PPs, as long as an underlying stimulus of type TROPE is involved.

Another crucial feature of tropes is that they are causally efficacious, see Maienborn and Herdtfelder (2017). Concrete objects do not enter causal relations, such that (37a) requires pragmatic enrichment along the lines discussed. (37b) is indeed conceptually much more felicitous.

- (37) a. #The leaves caused Kim to infer that it is autumn.
b. The golden colour of the leaves caused Kim to infer that it is autumn.

The causal efficacy of tropes lets Campbell (1981: 481) claim that “the philosophy of cause calls for tropes.” To sum up, the ontological category of tropes meets perfectly the conditions on the implicit stimulus of IPVs: they are perceivable on the boundary surface of concrete entities or constitute proper parts of entities as such, and may act as causers of mental states.

7. Conclusion

Evidential *an*PPs refer to directly perceived entities that constitute the basis of an inference drawn by an experiencer. As a result, they are restricted to IPVs because these select a propositional argument that expresses an inference and simultaneously provide an implicit argument for a perception stimulus. Analyzing evidential *an*PPs as event-internal modifiers best captures the interpretation that the implicit stimulus is conceptualized as part of the *an*-referent. Perceivable stimuli are of type TROPE and located on the reference object’s surface, or defining its conceptual boundaries. The causal efficacy of tropes matches the causal relation between the stimulus and the evoked mental state of the experiencer. While the relation between the stimulus and the modifier results from the latter’s verbadjacent position, the conceptualization of internal aspects of the reference object as information source follows the lexical semantics of *an*. The evidential reading of *an* is thus derivable by compositional means from the locative one. This work provides evidence for a uniform analysis of modification with *an*PPs. Further, it highlights the cognitive pertinence of the ontological category of tropes.

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