Reasoning with an (Experiential) Attitude*

Kristina Liefke

Institute for Linguistics, Goethe University Frankfurt, Germany
Liefke@lingua.uni-frankfurt.de

Abstract This paper gives a compositional semantics for attitude reports with nominal, gerund, and that-clause complements that captures the intuitive entailment relations between these reports (e.g. Ida sees/imagines a penguin diving ⇒ Ida sees/imagines a penguin). These relations are identified through the familiar diagnostic tests. We observe that entailments that are licensed by counterfactual attitude verbs (here: imagine) are largely different from the entailments between veridical vision reports that are described in (Barwise 1981). To capture this difference, we give a non-clausal syntax for gerund attitude reports and assign factive clausal complements a different semantics from non-factive and gerund complements. The resulting account captures the entailment patterns of imagination and vision reports without assuming special axioms in the lexical semantics of see or imagine. On our account, the 'logic' of the above reports thus falls directly out of their semantics.

Keywords: Perception reports · Imagination reports · Selectional flexibility · Entailment patterns · Predication theory · Situation semantics.

1 Introduction

Research on mental attitude reports has traditionally focused on reports of propositional attitudes (see [18, 37]; cf. [12]). The latter are sentences with a clausal complement (e.g. (1)) that have at least one of the following properties (see [46, p. 516]): (i) the complement's constituent expressions resist the truth-preserving substitution by a co-referential or truth-conditionally equivalent expression (i.e. *referential opacity [= non-transparency]*), (ii) the complement's constituent DPs lack existential import (i.e. *non-actuality*), and (iii) the complement's constituent existential DPs allow for a non-specific reading (i.e. *non-specificity*). The above properties are all exemplified in (1):

(1) Ida believes [$_{CP}$that there is [$_{DP}$a unicorn] in her garden]
- ⋡ a. Ida believes [$_{CP}$that there is [$_{DP}$a griffin] in her garden]
- ⋡ b. There is [$_{DP}$a unicorn] of which Ida believes [$_{CP}$that it is in her garden]
- ⋡ c. There are (actual/real-world) unicorns

* I thank three anonymous referees for valuable comments on an earlier version of this paper. The paper has profited from discussions with Sebastian Bücking, Kai von Fintel, Carla Umbach, and Ede Zimmermann. The research for this paper is supported by the German Research Foundation (via Ede Zimmermann's grant ZI 683/13-1).

In particular, on its *de dicto*-reading, (1) neither commits the attributor of the attitude to the existence of unicorns (i.e. (1) does not entail (1c); see (ii)) nor does it attribute to Ida the belief that there is a particular unicorn in her garden (i.e. (1) does not entail (1b); see (iii)) or that there is a griffin in her garden[1] (i.e. (1) does not entail (1a); see (i)).

The above properties are also exemplified by attitude reports with a nominal (i.e. direct object) complement (e.g. (2)). In virtue of their matrix verb's selection behavior, such reports are sometimes called *objectual attitude reports* (see [12]).

(2) Ida is searching $[_{\text{DP}}$a unicorn$]$

$\not\Rightarrow$ a. Ida is searching $[_{\text{DP}}$a griffin$]$

$\not\Rightarrow$ b. There is $[_{\text{DP}}$a unicorn$]$ which Ida is searching

$\not\Rightarrow$ c. There are (actual/real-world) unicorns

Many objectual attitude reports (incl. (2)) even lack a clausal equivalent. On the level of syntax, this is due to the DP-bias of their matrix verbs, s.t. the combination of these verbs with a clausal complement (e.g. (3)) is ungrammatical:

(3) *Ida is searching $[_{\text{CP}}$that $[_{\text{DP}}$a unicorn$]$ ...$]$

On the level of semantics, the lack of a clausal equivalent is due to the fact that many objectual attitude reports are intuitively not equivalent to the result of extending their direct object DP to a full CP (see [12, 13, 47], *pace* [37]). In particular, as regards (2), Ida may not be searching for a unicorn that exemplifies any particular property, but only for a *unicorn* (cf. [13, p. 829]). In this case, even the grammatical fix of (3), i.e. (4), is false and, hence, not equivalent to (2).

(4) Ida is searching $[_{\text{PP}}$for $[_{\text{DP}}$a unicorn that ...$]]$

The above prevents the obtaining of entailment relations of the form in (5), where 'V' and 'N' stand proxy for an intensional attitude verb and a common noun, respectively:

(5) a. Ida Vs $[_{\text{CP}}$that $[_{\text{DP}}$an N$]$ ...$]$ $\Rightarrow$ b. Ida Vs $[_{\text{DP}}$an N$]$

The above notwithstanding, entailments of the form of (5) are well-attested (see (6)). Such entailments involve reports with a DP/CP-neutral matrix verb whose complements describe a directly witnessed situation or event (see [17, 41]).

(6) a. Ida imagines $[_{\text{CP}}$that $[_{\text{DP}}$a unicorn$]$ is cantering in her garden$]$

$\Rightarrow$ b. Ida imagines $[_{\text{DP}}$a unicorn$]$

To capture the direct experiential nature of the actions that are described by these verbs, we call these verbs *experiential attitude verbs*.[2] They include counterfactual attitude verbs (e.g. imagine, dream), epistemic verbs (e.g. remember, notice), and perception verbs (e.g. see, hear). We will use the term *same-type attitude re-*

[1] This last possibility relies on the non-existence of unicorns and griffins in the actual world, such that the set of unicorns and the set of griffins are the same set (i.e. $\emptyset$).

[2] In linguistic semantics, the term *experiential attitude* only appears in the handout version of [41]. Anand [1] calls the relevant attitudes *imagistic attitudes*.

ports to describe pairs of experiential attitude reports with the same matrix verb that have grammatically different complements (e.g. a DP and a CP; see (6)).

The report in (6) illustrates the selectional flexibility of imagine between nominal and that-clause complements. However, experiential attitude verbs also combine with gerund complements[3] (see, e.g., (7a)) and license entailments from reports with this kind of complement (e.g. (7)):

(7) a. Ida imagines [$_{DP}$a unicorn] cantering in her garden
⇒ b. Ida imagines i. [$_{DP}$a unicorn] / ii. [$_{CP}$that [$_{DP}$a unicorn] is cantering ...]

This paper focuses on entailment relations between same-type attitude reports like the above. Our discussion of these relations will proceed in two steps: the first part of the paper (Sect. 2) uses the familiar diagnostic tests (i.e. non-cancellability, non-reinforceability) to identify the intuitive entailment relations between same-type attitude reports. The second part (Sect. 3–4) models these relations by assuming that the grammatically different complements in these reports are uniformly interpreted as propositions/propositionally coded situations.

Notably, for veridical vision reports (i.e. reports with factive uses of see), many of the above entailments have already been identified in early situation semantics (see [3]; cf. [2, 4, 8]). Our paper improves upon these results by capturing them in a standard compositional semantic framework, by extending them to other experiential attitude verbs (esp. imagine), and by dispensing of designated lexical semantic axioms. This extension is particularly important since different verbs (see vs. imagine) license different entailments, as we will see below.

2 Testing for Entailments

To investigate entailment relations between same-type attitude reports, we consider representative instances of each of the grammatically different 'types' of attitude reports from Section 1. These include reports with a nominal complement (see A, below; cf. (6b)), reports with a gerund complement (see C; cf. (7a)), and reports with a that-clause complement (see F; cf. (6a)).[4] To test for the intensionality of the embedded DP in these reports (see [46, p. 516]), we further consider variants of gerund reports that replace the restrictor of the embedded DP with an extensionally equivalent expression (here: Antarctic flightless bird, see D; cf. (1a), (2a)), that force a specific reading of the embedded DP (see E; cf. (1b), (2b)), and that modify the restrictor of the embedded DP by the adjective real-world, or actual (see B; cf. (1c), (2c)). Our use of reports D and E follows [3, pp. 376–377] (see [8, pp. 246–248]). Our use of B is inspired by the veridicality of vision reports (see [3, p. 376]; cf. [8, pp. 248–249]) and by the considerations in [12, p. 63 ff.].

[3] Higginbotham [16, p. 120] has pointed out that imagine – unlike see – does not accept bare infinitival complements. In view of this fact, we focus on gerund complements.

[4] To allow for minimal pairs of reports, we mark the complement in F for progressive aspect. For the same reason, we include the material in round brackets in B when B is contrasted with a gerund or clausal report.

A. Ida i. imagines / ii. sees [a penguin]
B. Ida i. imagines / ii. sees [a real-world penguin] (diving into the sea)
C. Ida i. imagines / ii. sees [a penguin] diving into the sea
D. Ida i. imagines / ii. sees [an Antarctic flightless bird] diving into the sea
E. There is [a penguin] which Ida i. imagines / ii. sees diving into the sea
F. Ida i. imagines / ii. sees that [a penguin] is diving into the sea

For A–F, we identify thirty interesting pairs of attitude reports (see Table 1). These pairs exclude identity pairs (marked '≡'). To test the interesting pairs for entailments, we use the familiar diagnostic tests (see [6]; cf. [14]). These include the non-cancellability of entailments (see Test 1, below) and the non-reinforceability of entailments (Test 2, below):

Test 1 (non-cancellability) *If $X \Rightarrow Y$ is an entailment, then 'X, but (it is) not (the case that) Y' is a contradiction in any context.* (see [3])

Test 2 (non-reinforceability) *If $X \Rightarrow Y$ is an entailment, then 'X and, specifically, Y' is redundant/semantically deviant.* (see [28, pp. 672–673]; cf. [19])

By applying the above tests to the interesting pairs of attitude reports, we yield the entailment judgements in Table 1. This table distinguishes different kinds (or 'types') of entailments: apart from *general* entailments (marked '⇒'), the pairs of reports from Table 1 also exemplify *lexical* entailments, i.e. entailments whose validity depends on the matrix attitude verb. The latter include entailments that only hold for (pairs of) imagination reports – but not for (pairs of) vision reports – ($\Rightarrow / \not\Rightarrow$), and entailments that only hold for vision reports – but not for imagination reports – ($\not\Rightarrow / \Rightarrow$).

	A	B	C	D	E	F
A	≡	$\not\Rightarrow / \Rightarrow$	$\not\Rightarrow$	$\not\Rightarrow$	$\not\Rightarrow$	$\not\Rightarrow$
B	⇒	≡	(⇒)	$\not\Rightarrow / \Rightarrow$	$\not\Rightarrow / \Rightarrow$	$\Rightarrow / \not\Rightarrow$
C	⇒	$\not\Rightarrow / \Rightarrow$	≡	$\not\Rightarrow / \Rightarrow$	$\not\Rightarrow / \Rightarrow$	$\Rightarrow / \not\Rightarrow$
D	$\not\Rightarrow / \Rightarrow$	$\not\Rightarrow / \Rightarrow$	$\not\Rightarrow / \Rightarrow$	≡	$\not\Rightarrow / \Rightarrow$	$\not\Rightarrow$
E	⇒	$\not\Rightarrow / \Rightarrow$	⇒	$\not\Rightarrow / \Rightarrow$	≡	$\Rightarrow / \not\Rightarrow$
F	$\not\Rightarrow$	$\not\Rightarrow$	$\Rightarrow / \not\Rightarrow$	$\not\Rightarrow$	$\not\Rightarrow$	≡

Class 1 Class 2 Class 3 Class 4 Class 5 Class 6

Table 1. Entailments between same-type attitude reports.

Table 1 identifies a total of 26 entailments (see the colored cells): nine for the imagine- and seventeen for the see-cases. Of these entailments, five are general (**Class 1**: B–C/E ⇒ A, B/E ⇒ C). Twelve entailments hold only for vision reports (see **Classes 2–4**, below); four hold only for imagination reports (**Class 5**: B–C/E ⇒ F; **Class 6**: F ⇒ C). Of the entailments that hold only for vision reports, four hold in virtue of DP-actuality (**Class 2:** A/C–E ⇒ B), seven hold

in virtue of DP-transparency (**Class 3:** B–C/E ⇒ D, D ⇒ A–C/E), and three in virtue of DP-specificity (**Class 4:** B–D ⇒ E). Our tests thus confirm the entailment judgements for vision reports from [3].

To facilitate future reference, we copy an example of each class below:

(8) a. C: Ida imagines/sees [a penguin] diving into the sea (**Class 1**)
⇒ b. A: Ida imagines/sees [a penguin]

(9) a. A: Ida i. imagines / ii. sees [a penguin] (**Class 2**)
b. B: Ida ⇏ i. imagines / ⇒ ii. sees [a real-world penguin]

(10) a. C: Ida i. imagines / ii. sees [a penguin] diving into the sea (**Cl. 3**)
b. D: Ida ⇏ i. imagines /
⇒ ii. sees [an Antarctic flightless bird] diving into the sea

(11) a. C: Ida i. imagines / ii. sees [a penguin] diving into the sea (**Cl. 4**)
b. E: There is [a penguin] which Ida ⇏ i. imagines /
⇒ ii. sees diving into the sea

(12) a. C: Ida i. imagines / ii. sees [a penguin] diving into the sea (**Cl. 5**)
b. F: Ida ⇒ i. imagines / ⇏ ii. sees that [a penguin] is diving ...

(13) a. F: Ida i. imagines / ii. sees that [a penguin] is diving ... (**Cl. 6**)
b. C: Ida ⇒ i. imagines / ⇏ ii. sees [a penguin] diving into the sea

The above shows that veridical see licenses largely different entailments from imagine: while the DP a penguin shows an *extensional* behavior in nominal and gerund complements of see (s.t. see licenses the entailments in (9)–(11)), it shows an *intensional* behavior in the complements of imagine (s.t. imagine does not license these entailments). Conversely, while gerund imagination reports entail the result of replacing their complement with its that-clause variant (i.e. they are *epistemically positive* in the sense of [3,9]; see (12)), gerund vision reports do not validate this entailment (i.e. they are *epistemically neutral*).

The rest of this paper provides a uniform semantics for imagination and vision reports that captures the above behavior. The provision of such a semantics is challenged by the fact that nominal, gerund, and that-clause complements of experiential attitude verbs are typically assigned different semantic types[5] (i.e. *se* [or $s((s(et))t)$], *s*, and *st*, respectively; see [12,30,41]), that gerund complements are commonly analyzed as syntactic constituents (see [3,17,41]), and that entailments like (12) are blocked on the basis of syntactic form (see [3,4,24]). The first two facts disable the obtaining of entailments between different-category complements (see (8)) and the easy manipulation of the scope of the embedded DP (see (11.ii)), respectively. The last fact makes it difficult to explain the different entailment patterns in (12).

[5] In what follows, we use a partial variant, TY_2^3, of Gallin's type logic TY_2 with basic types for individuals (type *e*), situations (type *s*), and (partial) truth-values (type *t*). Functions from objects of type α to objects of type β are written '$(\alpha\beta)$', or '$\alpha\beta$'.

In particular, situation semantics captures the non-entailment in (12.ii) (i.e. C.ii $\not\Rightarrow$ F.ii) by associating gerund (or bare infinitival) complementation with the *directness* of the attitude report, by associating that-clause complementation with the *indirectness* of the report, and by assuming that inferences from direct to indirect attitude reports are generally invalid (see [3, 24]). However, this move also predicts that C.i $\not\Rightarrow$ F.i, *contra* the relevant finding in Table 1.

3 Proposal and Background

We propose to solve the above problems by adopting a three-part strategy. This strategy involves (i) the same-type interpretation of nominal, gerund, and that-clause complements (along the lines of [43]), (ii) the assumption of a non-clausal syntax for gerund attitude reports (along the lines of [45]), and (iii) the use of a different semantics for the factive and the non-factive complementizer (see [23]). Parts (i) and (iii) help us capture the entailment relations between gerund and nominal respectively between gerund and that-clause reports (see (8), (12)–(13)). Part (ii) gives us a better handle on the scope of the embedded DP in such reports (i.e. it helps us explain the difference between (9.i)–(11.i) and (9.ii)–(11.ii)).[6]

3.1 The Semantics of Veridical Vision Reports

To capture the extensional behavior of the DP subject in the complement of veridical vision reports (see (9.ii)–(11.ii)), we adopt Williams' [45] predication theory of DP-predicate sequences (see Part (ii), above; cf. [38, 39]). The latter is a non-clausal syntax that analyzes the gerund in B–E as a non-constituent element of a ternary branching VP of the form [V DP XP]. The occurrences of see and imagine in B–E thus take two complements, i.e. a gerund VP predicate (here: diving into the sea; labelled 'XP') and a direct DP object (here: a penguin) that c-commands this predicate. In predication theory, a rule of predication co-indexes the XP with its c-commanding DP, thus indicating that the DP serves as the syntactic subject of the XP predicate. The predication-theoretic analysis of C.ii is given in (14):

(14) Ida $[_{\text{VP}}$sees $[_{\text{DP}}$a penguin$]_i$ $[_{\text{XP}}$diving into the sea$]_i]$

(14) suggests that the DP a penguin is the external argument of a maximal projection of X that is not c-commanded by the head of the XP. Since there is, thus, no need for a subject position inside the XP, the co-indexed DP and XP need not form a syntactic constituent, i.e. they are not clausal (see [29, p. 45]). This analysis differs from Barwise's [3, 4] 'S[mall] C[lause]'-account of such constructions (cf. the analysis of C.ii in (15); see [8, 41]) and from the standard analysis of attitude reports with finite that-clause complements, whose matrix verbs select for a single CP complement (see the analysis of F.ii in (16)):

(15) Ida $[_{\text{VP}}$sees $[_{\text{SC}}[_{\text{DP}}$a penguin$]$ $[_{\text{XP}}$diving into the sea$]]]$

(16) Ida $[_{\text{VP}}$sees $[_{\text{CP}}$that $[_{\text{TP}}[_{\text{DP}}$a penguin$]$ $[_{\text{VP}}$was diving into the sea$]]]]$

[6] We thus contradict van der Does' claim that "no semantical reason has been found to reject Small Clauses" (see [8, p. 246]).

To capture the extensional behavior of the embedded DP in veridical vision reports (see (9.ii)–(11.ii)) and the predication relation between the DP and the XP in the complement of these reports (see (14)), we assign 'DP XP'-taking occurrences of see the semantics in (17).[7] This semantics interprets see as a relation between an evaluation situation (in (17): k [resp. i]), an event (e), an agent (z), and a situation/visual scene (represented by a set of situations, $f_e(\lambda j.P_j(y))$).

(17) $[\![\text{see-DP XP}]\!]^i = \lambda\mathcal{Q}\lambda P\lambda z\,[\mathcal{Q}_i\,(\lambda k\lambda y\,(\exists e)[see_k\,(e, z, \underbrace{f_e(\lambda j.P_j(y))}_{\text{(a set of situations that codes) } z\text{'s visual scene in } k})])]$

Our use of a (coded) situation-argument is motivated by the observations in [41] (cf. [3, 17, 44]). These include the observation that the 'DP XP'-sequence in C.ii allows the truth-preserving substitution by a DP of the form a situation/event in which $[_{\text{TP}}\ ]$ (see (18); cf. [44]), that the verb see in this report can be modified by an 'experiential' modifier like in vivid/lifelike detail (see (19); cf. [41, p. 148]), and that this report implies the truth of a sentence (i.e. (20)) that reports the agent's direct witnessing of the event described by the complement (see [41, p. 147]):

(18) a. Ida sees $[_{\text{DP}}$a penguin$]_i$ $[_{\text{XP}}$diving into the sea$]_i$
≡ b. Ida sees $[_{\text{DP}}$*a visual scene* in which a penguin is diving into the sea]

(19) Ida sees $[_{\text{DP}}$a penguin] diving into the sea *in vivid/lifelike detail*

(20) Ida sees (= perceptually witnesses) a penguin diving into the sea

In (17), f is a subset selection function that chooses a subset from a given set of situations $\lambda j\,[\ldots]$ in dependence on a parameter, e, for the described attitudinal/perception event (here, z's seeing in k; cf. [11]). For e the agent's seeing event in k, this subset represents the visual scene that the agent perceives in e. Our use of *sets of* situations (rather than of a single situation) is motivated by the fact that – in contrast to visual scenes – imagined situations are often not anchored in a particular world or time, and by the possibility of representing non-anchored situations by sets of isomorphic [= qualitatively identical] situations (see [22, p. 667]; cf. [10, p. 136]). The latter are situations in which exactly the same propositions are true (resp. false). We will see below that the propositional interpretation of gerund complements facilitates the modelling of (8) and (12)–(13).

We have suggested above that the parameterizing event constrains the function f. In particular, we assume that, when it is parameterized by a seeing event, f selects from the set denoted by $\lambda j.P_j(y)$ (a subset representing) a situation to which the agent uniquely bears a visual acquaintance relation (in the sense of [7, 20, 25]). For (17), this relation is given, somewhat informally, in (21):

(21) $\lambda k\lambda z\,\lambda j\,[j$ is in z's field of vision in $k]$

[7] We hereafter adopt the following naming convention for variables: x, y, z are variables over individuals; i, j, k are variables over situations (or events); e is an event variable; p, q are variables over propositions (type st). P, Q are variables over type-$s(et)$ properties. $\mathcal{Q}$ is a variable over type-$s((s(et))t)$ quantifiers. A function's simultaneous application to a sequence of arguments indicates successive application in the reverse order of these arguments ('Currying'). Index arguments will be written in subscript.

The compositional interpretation of C.ii is given in Figure 1:[8]

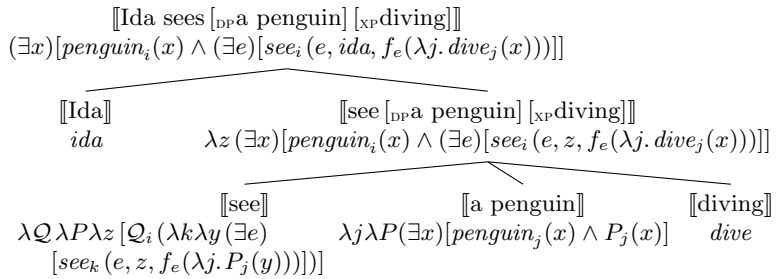

Figure 1. Compositional semantics for C.ii.

Note that (17) interprets the XP at (each member, j, of the set of situations that codes) z's perceived visual scene. This interpretation captures the informational asymmetry between the (extensionally behaved) DP and the (intensionally behaved) XP in gerund vision reports (see [2]): in contrast to (10), the substitution of the XP by an extensionally equivalent expression is intuitively invalid:

(22) a. C.ii: Ida sees a penguin [diving into the sea]
b. In the actual world, any penguin who is diving into the sea switches to anaerobic metabolism
$\not\Rightarrow$ c. Ida sees a penguin [switching to anaerobic metabolism]

Our previous considerations have focused on the interpretation of gerund reports. To give the semantics for nominal occurrences of see (e.g. A.ii), we use Stephenson's observation that the direct object DPs in such reports are also interpreted as situations (s. [41, p. 156]). The semantics of nominal see in (23) enables this interpretation.[9] This semantics differs from (17) only in dropping the argument place for the XP. To compensate for the absence of the property (P) that is denoted by the XP, we replace 'P' by a situation-relative existence predicate, E (see [26, p. 117 ff.]). The compositional interpretation of A.ii is given in Figure 2.

(23) $[\![\text{see-DP}]\!]^i = \lambda\mathcal{Q}\,\lambda z\,[\mathcal{Q}_i\,(\lambda k \lambda y\,(\exists e)[see_k\,(e, z, f_e(\lambda j.\, E_j(y)))])]$

The use of E in (23) is inspired by Parsons' *Hamlet ellipsis*-account of depiction and imagination reports (see [35, pp. 375–376]). This account analyzes the direct object DP in such reports as the result of eliding the XP being there from an embedded 'DP XP'-sequence (for A.ii: from a penguin being there; see (24b)):

(24) a. Ida [VP sees [DP a penguin]]
$\equiv$ b. Ida [VP sees [DP a penguin] [XP being there] (in her visual scene)]

[8] Since none of the relevant differences between A–E turns on the aspectual properties of the verb, we here neglect aspect.

[9] (23) is reminiscent of Montague's [33] interpretation of extensional verbs like find:

(†) $[\![\text{find-DP}]\!]^i = \lambda\mathcal{Q}\,\lambda z\,[\mathcal{Q}_i\,(\lambda k \lambda y.\, find_k\,(z, y))]$

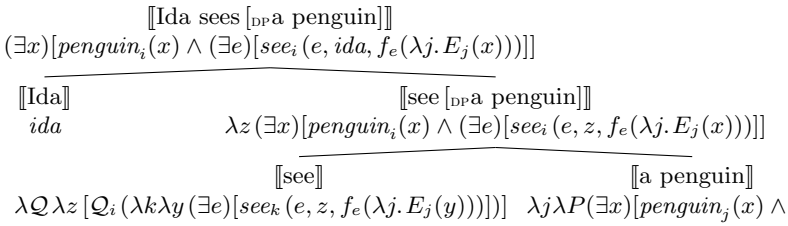

Figure 2. Compositional semantics for A.ii.

In fact, the full adoption of Parsons' account – on which the embedded DP in (24a) is an elliptical clause – would even allow us to avoid postulating a separate lexical entry for DP-taking see. However, this adoption would lead us to wrongly predict that (25) is ambiguous between a reading where yesterday modifies the matrix verb, see (i.e. (25a)), and a reading where yesterday modifies the implicit predicate, be there, in the verb's complement (i.e. (25b); cf. [12, p. 63 ff.]).

(25) Ida saw [$_{\text{DP}}$a penguin] yesterday
- ≡ a. Ida's seeing of a penguin occurred yesterday
- ≢ b. ??Ida saw yesterday's being(-there) of a penguin

By assuming that (24a) is only *equivalent* to (24b), we avoid this prediction.

We assume that clausal occurrences of see have (a close variant of) the familiar semantics, in (26). According to this semantics, clausal see presupposes the factivity of its complement. In (26), the factivity presupposition (underlined) on the clausal complement of see is written after a colon.

(26) $\llbracket \text{see-CP} \rrbracket^i = \lambda p : \underline{p_i}. \lambda z (\exists e)[see_i(e, z, p)]$

The factivity presupposition of see is supported by the observation that the negation of a clausal vision report still entails the truth of the embedded clause:

(27) a. Ida does not see [that a penguin is diving into the sea]
- ⇒ b. A penguin is diving into the sea

Our interpretation of see assumes that the factivity presupposition is triggered by the factive verb itself (for this view, see [5, 40]), rather than by the embedded clause (see, e.g., [21, 23]). This assumption is motivated by the observation that this presupposition is shared by vision reports like A.ii [≡ (24b)] or C.ii whose complement lacks a clausal analysis.

Arguably, to capture the factivity presupposition of nominal and gerund occurrences of see, one would need to replace (17) and (23) by the semantics in (28) and (29), respectively. However, to keep our semantics as simple as possible, we here use (17) and (23) instead.

(28) $\llbracket \text{see-DP XP} \rrbracket^i = \lambda \mathcal{Q} \lambda P\text{: } \underline{\mathcal{Q}_i(P)}. \lambda z [\mathcal{Q}_i (\lambda k \lambda y (\exists e)[see_k(e, z, f_e(\lambda j. P_j(y)))])]$

(29) $\llbracket \text{see-DP} \rrbracket^i = \lambda \mathcal{Q} : \underline{\mathcal{Q}_i(E)}. \lambda z [\mathcal{Q}_i (\lambda k \lambda y (\exists e)[see_k(e, z, f_e(\lambda j. E_j(y)))])]$

We close this section with an observation about the polysemy of see: our lexical entries in (17) (cf. (23)) and (26) suggest that see is polysemous[10] between

an experiential (i.e. (17)) and a 'propositional' use (26). This polysemy captures Barwise and Perry's distinction between direct [≈ experiential] and indirect [≈ propositional] perception reports. It is inspired by Dretske's [9] distinction between epistemic [≈ propositional] and non-epistemic [≈ experiential] perception.

We will show below that, by following Niiniluoto's assumption that imagine only has an experiential use (see [34], *pace* [36, 41]), we straightforwardly capture the validity of C.i ⇒ F.i and F.i ⇒ C.i (see (12), (13)). This assumption follows the intuition that – given the essential experiential nature of imagination – we cannot have indirect evidence about imaginary situations or events.

3.2 The Semantics of Imagination Reports

We have observed in Section 2 that imagination reports show a different entailment behavior from veridical vision reports. This behavior includes the *intensional* interpretation of the embedded DP in imagination reports. To capture this interpretation, we assume that the DP is interpreted *inside* the scope of imagine. Since we assume a non-clausal syntax for gerund attitude reports, we can then capture the entailment pattern of imagine in either of two ways:

The first way lies in the lexical decomposition of imagine into '■ to see', where ■ is an intensional operator. On this account, 'DP XP'-taking occurrences of imagine receive the semantics in (30):

(30) $[\![\text{imagine-DP XP}]\!]^i$
$= \lambda\mathcal{Q}\,\lambda P\lambda z\,[\blacksquare_i(z, \lambda j.\,\mathcal{Q}_j\,(\lambda k\lambda y\,(\exists e)[see_k\,(e, z, f_e(\lambda l.\,P_l(y)))]))]$

The above is reminiscent of Quine's [37] interpretation of seek as try to find (see (31); cf. [33, pp. 264, 267]), where try contributes the intensional operator:

(31) $[\![\text{seek-DP}]\!]^i = \lambda\mathcal{Q}\,\lambda z\,[try_i(z, \lambda j.\,\mathcal{Q}_j(\lambda k\lambda y.\,find_k\,(z, y)))]$

However, because of its similarity to (31), the semantics in (30) also inherits the challenges of this interpretation. These include the difficulty of specifying the identity of the intensional operator for some verbs[11] and of finding a suitable lexical decomposition of these and other verbs (see [31, pp. 177]). The specification of ■ is required by the need to assign a distinct semantics to verbs (e.g. imagine, visualize, and hallucinate) that all suggest a lexical decomposition in terms of see.

We avoid the above problems by adopting instead the semantics for imagine in (32). This semantics interprets imagine as a lexical primitive that takes scope over its DP complement. The interpretation of imagine in (32) follows Montague's [32] interpretation of seek (cf. [30]), in (33):

(32) $[\![\text{imagine-DP XP}]\!]^i = \lambda\mathcal{Q}\,\lambda P\lambda z\,(\exists e)[imagine_i\,(e, z, f_e(\lambda j.\,\mathcal{Q}_j(P)))]$

(33) $[\![\text{seek-DP}]\!]^i = \lambda\mathcal{Q}\,\lambda z\,[seek_i\,(z, \mathcal{Q})]$

Following the above interpretation strategy, transitive occurrences of imagine are interpreted as a DP-low-scope version of (23) (in (34)). To capture the

[10] Since these lexical entries have a common semantic core, see is not ambiguous.

[11] This is particularly problematic in view of competing philosophical analyses of imagination, like imagine seeing, seeming to see, and pretending (to oneself) to see.

essential experiential nature of imagination,[12] we interpret clausal imagine as a relation to a coded situation, rather than to a classical proposition (see our elaborations above). The relevant entry is given in (35):

(34) $[\![\text{imagine-DP}]\!]^i = \lambda\mathcal{Q}\,\lambda z\,(\exists e)[\mathit{imagine}_i(e, z, f_e(\lambda j.\,\mathcal{Q}_j(E)))]$

(35) $[\![\text{imagine-CP}]\!]^i = \lambda p\,\lambda z\,(\exists e)[\mathit{imagine}_i(e, z, f_e(p))]$

Note that, in contrast to see, imagine does not presuppose the factivity of its complement. The absence of the factivity presupposition in (35) captures the fact that imagination is a counterfactual attitude (i.e. we can also imagine what is *not* there). We will return to this point in the next section.

4 Capturing the Entailments

With our entries for see and imagine in place, we can now show that our proposed semantics captures the different entailment patterns from Section 2:

4.1 Modelling Classes 2–4: DP-extensionality entailments

Our semantics for 'DP XP'-taking occurrences of see (in (17)) ensures that the interpretation of the embedded DP subject in vision reports is specific (i.e. the quantifier that is denoted by the DP lies outside the scope of see) and referentially transparent (i.e. the restrictor of the DP is interpreted at the evaluation situation i). In virtue of this fact, gerund vision reports are always interpreted *de re*:

(36) $[\![\text{C.ii}]\!]^i_{\textit{de dicto}} \equiv [\![\text{Ida sees } [_{\text{DP}}\text{a penguin}]\,[_{\text{XP}}\text{diving into the sea}]]\!]^i$
$= (\exists x)[\mathit{penguin}_i(x) \wedge (\exists e)[\mathit{see}_i(e, \mathit{ida}, f_e(\lambda j.\,\mathit{dive}_j(x)))]]$
$\equiv (\lambda P(\exists x)[\mathit{penguin}_i(x) \wedge P_i(x)])$
$(\lambda k\,\lambda x_1(\exists e)[\mathit{see}_k(e, \mathit{ida}, f_e(\lambda j.\,\mathit{dive}_j(x_1)))])$
$= [\![\text{C.ii}]\!]^i_{\textit{de re}} \equiv [\![[\text{a penguin}]\,[\lambda_1\,[\text{Ida sees } t_1\ [_{\text{XP}}\text{diving into the sea}]]]]\!]^i$

In particular, as a result of the DP's transparent interpretation, the restrictor, i.e. penguin, admits substitution *salva veritate* by an extensionally equivalent expression (here: by the complex noun Antarctic flightless bird, in (37); see **Class 3.ii**) and allows for a truth-preserving modification by the adjective real-world (in (39); see **Class 2.ii**). The latter uses the interpretation of real-world in (38), where w_i is a variable for the world that is associated with the evaluation situation (i):

(37) a. $[\![\text{C.ii}]\!]^i \equiv [\![\text{Ida sees } [_{\text{DP}}\text{a penguin}]\,[_{\text{XP}}\text{diving into the sea}]]\!]^i$
$= (\exists x)[\mathit{penguin}_i(x) \wedge (\exists e)[\mathit{see}_i(e, \mathit{ida}, f_e(\lambda j.\,\mathit{dive}_j(x)))]]$

b. (Ext) $(\forall x)[\mathit{penguin}_i(x) \leftrightarrow \mathit{antarctic\text{-}flightless\text{-}bird}_i(x)]$

$\Leftrightarrow$ c. $[\![\text{D.ii}]\!]^i \equiv [\![\text{Ida sees [an Antarctic flightless bird] diving into the sea}]\!]^i$
$= (\exists x)[\mathit{antarctic\text{-}flightless\text{-}bird}_i(x) \wedge (\exists e)[\mathit{see}_i(e, \mathit{ida}, f_e(\lambda j.\,\mathit{dive}_j(x)))]]$

[12] This nature is supported by the observation (corroborated by a corpus study by Carla Umbach) that even reports like F.i allow for experiential modification (see (‡)):

(‡) Ida *vividly* imagines that a penguin is diving into the sea

(38) $[\![\text{real-world } [_{\text{N}}\ ]]\!] = \lambda P \lambda j \lambda x\, [P_j(x) \wedge E_{w_i}(x)]$

(39) a. $[\![\text{C.ii}]\!]^i = \underline{(\exists x)[\mathit{penguin}_i(x) \wedge (\exists e)[\mathit{see}_i(e, \mathit{ida}, f_e(\lambda j.\, \mathit{dive}_j(x)))]]}$

$\Leftrightarrow$ b. $[\![\text{B.ii}]\!]^i \equiv [\![\text{Ida sees [a real-world penguin] diving into the sea}]\!]^i$

As a result of the specific interpretation of the DP a penguin, C.ii is equivalent to the report E.ii (see (42); **Class 4.ii**). Our proof of this equivalence uses the semantics of the relativizer which from (40) (see [15, p. 82 ff.]). The predicate be there is interpreted through the existence predicate E (see (41)):

(40) $[\![\text{which}]\!] = \lambda Q \lambda P \lambda j \lambda y\, [P_j(y) \wedge Q_j(y)]$

(41) $[\![\text{be there}]\!]^i \equiv [\![\text{exist}]\!]^i = \lambda \mathcal{Q}\, [\mathcal{Q}_i\, (\lambda j \lambda y.\, E_j(y))]$

Together, the above enable the compositional interpretation of E.ii in (42b):

(42) a. $[\![\text{C.ii}]\!]^i = \underline{(\exists x)[\mathit{penguin}_i(x) \wedge (\exists e)[\mathit{see}_i(e, \mathit{ida}, f_e(\lambda j.\, \mathit{dive}_j(x)))]]}$

$\Leftrightarrow$ b. $[\![\text{E.ii}]\!]^i \equiv [\![\text{There is } [_{\text{DP}}\text{a penguin}] \text{ which Ida sees } [_{\text{XP}}\text{diving } \ldots]]\!]^i$

$\equiv [\![\text{there is}]\!]^i\big([\![\text{a}]\!]\big([\![\text{which}]\!]\big([\![\text{penguin}]\!], \lambda_1.[\![\text{Ida sees } t_1 \text{ dive}]\!]\big)\big)\big)$

$= \lambda \mathcal{Q}\, [\mathcal{Q}_i\, (\lambda j \lambda y.\, E_j(y))]\big(\lambda k \lambda P\, (\exists x)[\mathit{penguin}_k(x) \wedge (\exists e)[\mathit{see}_k(e, \mathit{ida}, f_e(\lambda l.\, \mathit{dive}_l(x))) \wedge P_k(x)]]\big)$

Note: A more standard, i.e. 'clausal' version of (17) (in (43); cf. (15)) may try to capture (9.ii)–(11.ii) by interpreting the complement in C.ii as a syntactic constituent (see the S[mall] C[lause] in (43)) and by adopting the quantifier exportation rule **DP-Exp** (cf. [4, p. 182]) as an axiom in the lexical semantics of see:

(43) $[\![\text{see } [_{\text{SC}}[_{\text{DP}}\ ]\,[_{\text{XP}}\ ]]]\!]^i = \lambda p \lambda z\, (\exists e)[\mathit{see}_i(e, z, f_e(p))]$

(44) (**DP-Exp**) $(\forall P)(\forall Q)(\forall z)(\forall e)[\mathit{see}_i(z, f_e(\lambda j\, \exists x.\, P_j(x) \wedge Q_j(x))) \rightarrow (\exists y)[P_i(y) \wedge \mathit{see}_i(z, f_e(\lambda j.\, Q_j(y)))]]$

However, because of the order-insensitivity of conjunction, this rule wrongly predicts that the embedded predicate in C.ii (i.e. diving into the sea) likewise has an extensional interpretation (*contra* (22); cf. [2, 8]). The difficulty of finding a weaker variant of **DP-Exp** that avoids this prediction – and the ease of capturing (9.ii)–(11.ii) through (17) – provides support for our non-clausal analysis.

In contrast to our semantics for 'DP XP'-taking see, our semantics for 'DP XP'-taking imagine (in (32)) allows for the possibility that the embedded DP subject receives a non-specific and referentially opaque interpretation. As a result, the *de dicto*-reading of C.i (i.e. Ida imagines a penguin diving; in (45a)) has a different interpretation from the report's *de re*-reading (see (45b)). The identification of E.i (i.e. There is a penguin which Ida imagines diving) with the *de re*-reading of C.i (see (45b)) then captures the non-entailment from C.i to E.i (**Class 4.i**):

(45) a. $[\![\text{C.i}]\!]^i_{de\ dicto} \equiv [\![\text{Ida imagines } [_{\text{DP}}\text{a penguin}]\,[_{\text{XP}}\text{diving into the sea}]]\!]^i$

$= (\exists e)[\mathit{imagine}_i(e, \mathit{ida}, f_e(\lambda j\, \exists x.\, \mathit{penguin}_j(x) \wedge \mathit{dive}_j(x)))]$

$\not\Leftrightarrow$ b. $[\![\text{C.i}]\!]^i_{de\ re} \equiv [\![[\text{a penguin}]\,[\lambda_1\,[\text{Ida imagines } t_1\ [_{\text{XP}}\text{diving } \ldots]]]]\!]^i$

$= (\exists x)[\mathit{penguin}_i(x) \wedge (\exists e)[\mathit{imagine}_i(e, \mathit{ida}, f_e(\lambda j.\, \mathit{dive}_j(x)))]]$

$= [\![\text{E.i}]\!]^i = [\![\text{there is}]\!]^i\big([\![\text{a}]\!]\big([\![\text{which}]\!]\big([\![\text{penguin}]\!], \lambda_1.[\![\text{Ida imagines } t_1 \text{ dive}]\!]\big)\big)\big)$

The opaque interpretation of the embedded DP in the *de dicto*-reading of C.i (see (45a)) blocks the entailment to D.i (i.e. Ida imagines an Antarctic flightless bird diving; see (46); **Class 3.i**) and B.i (i.e. Ida imagines a real-world penguin diving; see (47); **Class 2.i**):

(46) a. $[\![\text{C.i}]\!]^i_{de\ dicto} = (\exists e)[imagine_i(e, ida, f_e(\lambda j\, \exists x.\, penguin_j(x) \wedge dive_j(x)))]$

b. (Int) $(\exists j)(\exists x)[penguin_j(x) \wedge \neg antarctic\text{-}flightless\text{-}bird_j(x)]$

$\not\Rightarrow$ c. $[\![\text{D.i}]\!]^i_{de\ dicto} \equiv [\![\text{Ida imagines } [_{\text{DP}}\text{an Antarctic flightl. bird}]\, [_{\text{XP}}\text{diving}]]\!]^i$
$= (\exists e)[imagine_i(e, ida,$
$f_e(\lambda j\, \exists x.\, antarctic\text{-}flightless\text{-}bird_j(x) \wedge dive_j(x)))]$

(47) a. $[\![\text{C.i}]\!]^i_{de\ dicto} = (\exists e)[imagine_i(e, ida, f_e(\lambda j\, \exists x.\, penguin_j(x) \wedge dive_j(x)))]$

$\not\Rightarrow$ b. $[\![\text{B.i}]\!]^i_{de\ dicto} \equiv [\![\text{Ida imagines [a real-world penguin] } [_{\text{XP}}\text{diving } \ldots]]\!]^i$
$= (\exists e)[imagine_i(e, ida, f_e(\lambda j\, \exists x.\, (penguin_j(x) \wedge \underline{E_{\boldsymbol{w_i}}(x)}) \wedge dive_j(x)))]$

4.2 Modelling Class 1: propositional-to-nominal entailments

We have pointed out in Section 3.1 that, in virtue of our interpretation of transitive occurrences of see (cf. (23)), our semantics assigns to nominal vision reports the same interpretation as to the result of enriching the object DP in these reports with the XP being there (see (24)). Our interpretation of transitive occurrences of imagine gives rise to the same kind of equivalence. For imagine, this equivalence is captured below:

(48) $(\forall \mathcal{Q})(\forall z)\big[[\![\text{imagine-DP}]\!]^i(\mathcal{Q})(z) \equiv [\![\text{imagine-DP XP}]\!]^i(\mathcal{Q})(E)(z)\big]$

(48) enables the obtaining of entailment relations between imagination reports with gerund and nominal complements. In particular, the entailment in (8) (cf. **Class 1**) is supported by the fact that being a penguin (in a situation) is a more general property than being a penguin who is diving into the sea (in this situation) (see (49b)). The entailment further relies on the intuitive parthood principle ($\subseteq$) and on the upward-monotonicity, M↑, of the complement of imagine:

(49) a. $[\![\text{C.i}]\!]^i_{de\ dicto} = (\exists e)[imagine_i(e, ida, f_e(\lambda j\, \exists x.\, penguin_j(x) \wedge dive_j(x)))]$

b. (Gen) $(\forall j)(\forall x)[(penguin_j(x) \wedge dive_j(x)) \rightarrow penguin_j(x)]$

c. ($\subseteq$) $(\forall p)(\forall q)[p \subseteq q \rightarrow (\forall e.\, f_e(p) \subseteq f_e(q))]$

d. (M↑) $(\forall p)(\forall z)(\forall e)[imagine_i(e, z, p) \rightarrow (\forall q.\, p \subseteq q \rightarrow imagine_i(e, z, q))]$

$\Rightarrow$ e. $[\![\text{A.i}]\!]^i_{de\ dicto} \equiv [\![\text{Ida imagines [a penguin]}]\!]^i$
$= (\exists e)[imagine_i(e, ida, f_e(\lambda j\, \exists x.\, penguin_j(x)))]$

4.3 Modelling Classes 5–6: positivity- & experientiality-entailments

We have seen in Section 2 that only imagine – but not see – licenses the replacement of its gerund complements by their that-clause variants (see (12)). To block the entailment from C.ii to F.ii (i.e. Ida sees that a penguin is diving into the sea), we follow Kratzer's [23] assumptions that that is ambiguous between the propositional complementizer, i.e. that_{P}, and the factive complementizer, i.e. that_{F}, and that clause-taking occurrences of factive verbs (incl. see) select for clauses

with the factive complementizer. Kratzer assumes that that_{F} receives the interpretation in (50). Given a simple variant of her analysis of exemplification (see [22, pp. 660–661], [24, § 6]), this interpretation can be formalized as (51), where $\leq$ is a partial (i.e. spatio-temporal/informational inclusion-)ordering on situations:

(50) $\lambda p \lambda j\,[\mathit{exemplify}\,(p, j)]$

(51) $[\![\text{that}_{\text{F}}]\!] \;=\; \lambda p.\, \Pi\,(p)$, where $\Pi \;:=\; \lambda q \lambda j\,[q_j \wedge (\forall k.(q_k \wedge k \leq j) \rightarrow k = j)]$

In virtue of (51) and the lexical entry for clausal see (in (26)), the *de re*-reading of F.ii receives the interpretation in (52c). This interpretation asserts the obtaining of the seeing relation between Ida and the set of facts [= minimal situations] in which a particular real-world penguin is diving into the sea. Since visual scenes typically do <u>not</u> represent isolated facts, the scene that serves as the argument of C.ii will likely not be a member of this set.[13] The non-inclusion of the set, $f_e(\lambda j.\, \mathit{dive}_j(x))$, that codes this scene in the set $\Pi(\lambda j.\, \mathit{dive}_j(x))$ (see (52b)) then captures the non-validity of C.ii $\Rightarrow$ F.ii (see **Class 5.ii**).[14]

(52) a. $[\![\text{C.ii}]\!]^i \;=\; (\exists x)\,[\mathit{penguin}_i(x) \wedge (\exists e)[\mathit{see}_i\,(e, \mathit{ida}, f_e(\lambda j.\, \mathit{dive}_j(x)))]]$

b. $\underline{(\forall x)(\forall e)(\exists k)[f_e(\lambda j.\, \mathit{dive}_j(x))(k) \wedge \neg \Pi\,(\lambda j.\, \mathit{dive}_j(x))(k)]}$

$\not\Rightarrow$ c. $[\![\text{F.ii}]\!]^i_{\mathit{de\ re}} \equiv [\![[\text{a penguin}]\,[\lambda_1\,[\text{Ida sees}\,[_{\text{CP}}\text{that}\ t_1\ \text{is diving}\ \ldots]]]]\!]^i$
$= (\exists x)[\mathit{penguin}_i(x) \wedge (\exists e)[\mathit{see}_i\,(e, \mathit{ida}, \Pi\,(\lambda j.\, \mathit{dive}_j(x)))]]$

The non-inclusion of the set $\Pi\,(\lambda j.\, \mathit{dive}_j(x))$ in the set $f_e(\lambda j.\, \mathit{dive}_j(x))$ explains the non-validity of the entailment in the other direction (see **Class 6.ii**).

Since it is non-factive, imagine selects for the propositional complementizer that_{P}. When combined with the lexical entry for clausal imagine (see (35)), the semantics of that_{P} (in (53)) captures the validity of C.i $\Rightarrow$ F.i, as desired (see (54) for the *de dicto*-case).

(53) $[\![\text{that}_{\text{P}}]\!] \;=\; \lambda p \lambda j\,[p_j]$ (i.e. that_{P} is semantically vacuous)

(54) a. $[\![\text{C.i}]\!]^i_{\mathit{de\ dicto}} = (\exists e)[\mathit{imagine}_i(e, \mathit{ida}, f_e(\lambda j\, \exists x.\, \mathit{penguin}_j(x) \wedge \mathit{dive}_j(x)))]$

b. $\underline{(\text{M}\uparrow)\ (\forall p)(\forall z)(\forall e)[\mathit{imagine}_i(e, z, p) \rightarrow (\forall q.\, p \subseteq q \rightarrow \mathit{imagine}_i(e, z, q))]}$

a. $\Leftrightarrow$ c. $[\![\text{F.i}]\!]^i_{\mathit{de\ dicto}} \equiv [\![\text{Ida imagines [that a penguin is diving into the sea]}]\!]^i$

Since the semantic arguments of the occurrences of imagine in C.i and F.i are, in fact, identical, the entailment in the other direction is also valid (see **Class 6.i**).

[13] The latter is the case if Ida's perceived visual scene includes information beyond the fact that the penguin is diving into the sea, e.g. that the penguin has a black face and/or that its feet are covered in dirt.

[14] Alternatively, one could try to capture this non-validity by combining (51) with a see-variant of (35). However, the resulting account would counterintuitively interpret the complement in F.ii as a single fact (with a specific spatio-temporal location in w_i), rather than as a sets of facts (with different spatio-temporal locations in w_i). Since this account would further need to explain C.ii $\not\Rightarrow$ F.ii through the (dubious) non-inclusion of the fact $f_e(\Pi(\lambda j.\, \mathit{dive}_j(x)))$ in the situation, $f_e(\lambda j.\, \mathit{dive}_j(x))$, of which this fact is true, we refrain from adopting this account.

5 Outlook

We expect that the proposed semantics can be straightforwardly extended to capture the entailment properties of other experiential attitude verbs (e.g. remember, hallucinate) that cut across the entailment patterns of see and imagine. This is achieved by combining the intensional interpretation of the embedded DP subject in (32) and (34) with the selection for factive clauses like (51) (for remember) and by assigning this DP a specific, but referentially opaque interpretation through Szabó's [42] rule of split raising (for hallucinate).

References

[1] P. Anand, *Suppositional projects and subjectivity*, Michigan Linguistics and Philosophy Workshop (2011), 1–22.

[2] N. Asher and D. Bonevac, *How extensional is extensional perception?*, Linguistics and Philosophy **8/2** (1985), 203–228.

[3] J. Barwise, *Scenes and other situations*, J. of Philosophy **78/7** (1981), 369–397.

[4] J. Barwise and J. Perry, *Situations and Attitudes*, MIT Press, Cambridge, 1983.

[5] D. Beaver and B. Geurts, *Presupposition*, Stanford Encyclopedia of Philosophy: Summer 2011 edition (E.N. Zalta, ed.), `plato.stanford.edu/archives/sum2011/entries/presupposition`.

[6] M. Blome-Tillmann, *Conversational implicatures (and how to spot them)*, Philosophy Compass **80/2** (2013), 170–185.

[7] M.J. Cresswell and A. von Stechow, De re *belief generalized*, Linguistics and Philosophy **5/4** (1982), 503–35.

[8] J. van der Does, *A generalized quantifier logic for naked infinitives*, Linguistics and Philosophy **14/3** (1991), 241–294.

[9] F. Detske, *Seeing and knowing*, Mind **79** (1970), 281–287.

[10] K. Fine, *Properties, propositions, and sets*, J. of Philos. Logic **6** (1977), 135–191.

[11] K. von Fintel, *Quantifier domain selection and pseudo-scope*, Handout from a talk at the Cornell Conference on Theories of Context Dependency, `http://mit.edu/fintel/fintel-1999-cornell-context.pdf`, 1999.

[12] G. Forbes, *Attitude Problems*: *An essay on linguistic intensionality*, Oxford University Press, Oxford and New York, 2006.

[13] A. Grzankowski, *Limits of propositionalism*, Inquiry **57/7–8** (2016), 819–838.

[14] H.P. Grice, *Logic and conversation*, Syntax and Semantics III: Speech Acts (P. Cole and J. L. Morgan, eds.), Academic Press, New York, 1989, pp. 41–58.

[15] I. Heim and A. Kratzer, *Semantics in Generative Grammar*, Blackwell Textbooks in Linguistics, vol. 13, Blackwell, Malden, MA and Oxford, 1998.

[16] J. Higginbotham, *The logic of perceptual reports*: *An extensional alternative to situation semantics*, Journal of Philosophy **80/2** (1985), 100–127.

[17] ———, *Remembering, imagining, and the first person*, Epistemology of Language (A. Barber, ed.), Oxford University Press, Oxford, 2003, pp. 496–533.

[18] J. Hintikka, *Semantics for propositional attitudes*, Philosophical Logic (J. W. Davis et al., ed.), Reidel, Dordrecht, 1969, pp. 21–45.

[19] L.R. Horn, *On the Semantic Properties of the Logical Operators in English*, Chicago University Press, Chicago, 1972.

[20] D. Kaplan, *Quantifying in*, Synthese **19/1–2** (1969), 178–214.

[21] P. Kiparsky and C. Kiparsky, *Fact*, Progress in Linguistics: A collection of papers (M. Bierwisch and K.E. Heidolph, eds.), Mouton, The Hague, 1970, pp. 143–73.
[22] A. Kratzer, *Facts: particulars or information units?*, Linguistics and Philosophy **25/5-6** (2002), 655–670.
[23] ———, *Decomposing attitude verbs*, Handout, Hebrew Univ. of Jerusalem (2006).
[24] ———, *Situations in natural language*, Stanford Encyclopedia of Philosophy: Summer 2019 edition (E.N. Zalta, ed.), `https://plato.stanford.edu/entries/situations-semantics/`.
[25] D. Lewis, *Attitudes* de dicto *and* de se, Phil. Review **88/4** (1979), 513–543.
[26] K. Liefke, *A Single-Type Semantics for Natural Language*, Dissertation, Tilburg Center for Logic and Philosophy of Science, Tilburg, 2014.
[27] ———, *Saving Hamlet ellipsis*, Logic and Algorithms in Computational Linguistics 2018 (R. Loukanova, ed.), Studies in Computational Intelligence, vol. 860, Springer, Cambridge, 2020, pp. 17–43.
[28] K. Liefke and M. Werning, *Evidence for single-type semantics – an alternative to e/t-based dual-type semantics*, Journal of Semantics **35/4** (2018), 639–685.
[29] K. Lundin, *Small Clauses in Swedish: Towards a unified account*, Dissertation, Lund University, Lund, 2003.
[30] F. Moltmann, *Intensional verbs and quantifiers*, Nat. Lang. Sem. **5/1** (1997), 1–52.
[31] R. Montague, *On the nature of certain philosophical entities*, The Monist **41** (1969), 159–194.
[32] ———, *Universal grammar*, Theoría **36/3** (1970), 373–398.
[33] ———, *The proper treatment of quantification in ordinary English*, Approaches to Natural Language (J. Hintikka, ed.), Reidel, Dordrecht, 1973, pp. 221–242.
[34] I. Niiniluoto, *Imagination and fiction*, Journal of Semantics **4/3** (1985), 209–222.
[35] T. Parsons, *Meaning sensitivity and grammatical structure*, Structures and Norms in Science, Springer, Dordrecht, 1997, pp. 369–383.
[36] C. Peacocke, *Implicit conceptions, understanding and rationality*, Philosophical Issues **9** (1998), 43–88.
[37] W.V. Quine, *Quantifiers and propositional attitudes*, Journal of Philosophy **53/5** (1956), 177–187.
[38] S. Rothstein, *The Syntactic Forms of Predication*, MIT, Cambridge, 1983.
[39] B. Schein, *Small clauses and predication*, Syntax and Semantics **28** (1995), 49–76.
[40] P. Schlenker, *Be articulate: A pragmatic theory of presupposition projection*, Theoretical Linguistics **34** (2008), 157–212.
[41] T. Stephenson, *Vivid attitudes: Centered situations in the semantics of 'remember' and 'imagine'*, Proceedings of SALT XX, 2010, pp. 147–160.
[42] Z. Gendler Szabó, *Specific, yet opaque*, Logic, Language and Meaning, Springer, Berlin, 2010, pp. 32–41.
[43] N. Theiler, F. Roelofsen, and M. Aloni, *A uniform semantics for declarative and interrogative complements*, Journal of Semantics **35/3** (2018), 409–466.
[44] C. Umbach, S. Hinterwimmer, and H. Gust, *German 'wie'-complements: Manners, methods and events in progress* (submitted), `tinyurl.com/wxm5lp5`.
[45] E.S. Williams, *Against small clauses*, Linguistic Inquiry **14/2** (1983), 287–308.
[46] T.E. Zimmermann, *Unspecificity and intensionality*, Audiatur Vox Sapentiae (C. Féry and W. Sternefeld, eds.), Akademie Verlag, Berlin, 2001, pp. 524–543.
[47] ———, *Painting and opacity*, Von Rang und Namen (W. Freitag, H. Rott, H. Sturm, and A. Zinke, eds.), Mentis, Münster, 2016, pp. 427–453.