

# CONTENT INDIVIDUALS, TRUTHMAKING CONDITIONS, AND THE FORMAL SEMANTICS OF ATTITUDE REPORTS

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In her rich paper, Friederike Moltmann provides an extension of standard (= sentence-based) truthmaker semantics that (i) generalizes the familiar truthmaking relation to attitudinal, modal, and intensional objects and that (ii) applies the result of this generalization (called *object-based truthmaker semantics*, hereafter ‘OTS’) to the interpretation of different kinds of mental attitude reports (incl. reports with clause-taking and with intensional transitive verbs). The paper supports OTS by (iii) showing its empirical and conceptual advantages over traditional, possible world-style, Hintikka semantics.

My comment focuses on Moltmann’s contributions (ii) and (iii), concentrating on the advantages of OTS over sophisticated versions of Hintikka semantics (see my Sect. 1) and on the compositional implementation of OTS (Sect. 2). My objective in this comment is to suggest ways in which OTS may solve several open problems for sophisticated Hintikka-style semantics that are not mentioned in Moltmann’s paper (see Sect. 1) and in which OTS’ compositional implementation may profit from recent linguistic work on the formal semantics of attitude reports (see Sect. 2).

My suggestions will show that a large part – though clearly not all – of OTS’ support comes from its adoption of content individuals (Moltmann’s *concrete, content-bearing objects*) and is independent of their integration into truthmaker semantics. This raises the question whether it might make sense to start with content individuals alone (together with a modifier-analysis of clausal complements) and only specify the individuals’ truth-making conditions when these are lexically or contextually required. Given the existence of well-developed compositional semantics with content individuals (see e.g. Kratzer, 2006; Moulton, 2009, 2015), this would facilitate the integration of truth-making into mainstream formal semantics of natural language.

For reasons of space – and since I believe that Moltmann is basically right about OTS’ merits w.r.t. the analysis of obligation and strong and weak permission –, I will not discuss Moltmann’s account of modal sentences and objects.

## 1. FURTHER SEMANTIC SUPPORT FOR OTS

Moltmann starts her paper by suggesting that OTS answers the familiar arguments against traditional, possible world-style, Hintikka semantics with a Relational Analysis of attitude reports (see her Introduction and her Sect. 5, 13). These include the inability of possible-world semantics to distinguish the semantic contributions of logically equivalent expressions (see e.g. Lewis, 1972; Cresswell, 1973), to capture the intuitive notions of partial content and subject matter (see Barwise & Perry, 1983; Yablo, 2014), and to solve Prior’s (1971) substitution problem and explain Moltmann’s objectivization effect (see King, 2002; Moltmann, 2003, 2013a).

Since recent work in the Hintikkaean tradition<sup>1</sup> has provided more-or-less satisfactory solutions to these problems – and since it is not clear how OTS answers sophisticated

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I thank Friederike Moltmann, Dolf Rami, Christopher Tancredi, Markus Werning, and Thomas Ede Zimmermann for valuable discussions about many of the topics in this comment. The writing of this comment was supported by the German Research Foundation (via Ede Zimmermann’s grant ZI 683/13-1).

<sup>1</sup>This work e.g. replaces (possible or impossible) worlds by informationally partial (possible or impossible) situations (see Perry, 1986; Liefke & Werning, 2018; cf. Kratzer, 1989, 2002), identifies the semantic

variants of logical omniscience (see e.g. Soames, 1985) or how exactly it explains the objectivization effect (but see my Sect. 2.2) –, I do not believe that the above are particularly strong arguments for OTS. That said, I *do* believe that OTS has the potential to answer several open problems in contemporary Hintikka-style formal semantics (besides the ones mentioned in Moltmann’s paper). Since these problems/solutions provide further support for OTS<sup>2</sup> – and since they show the respective role of OTS’ effective ingredients, i.e. content individuals and truthmaking conditions –, I present some of them below.

*Note:* The problem from Section 1.1 below is already indirectly answered in (Moltmann, 2008, Sect. 6.2.4) (see also Moltmann, 2013a, Ch. 5; 2015b; 2015a).<sup>3</sup> However, since (Moltmann, 2008) and (Moltmann, 2013a, 2015a,b) are more concerned with the sharing than with the ‘not-sharing’ of intensional objects, since they do not formally spell out their answer to this problem<sup>4</sup>, and since they leave open some questions about the respective role of (kinds of) content individuals and (types of) truthmaking conditions, I include Moltmann’s answer below:

**1.1. Inferences to a common objective.** Inferences to a common objective (see Zimmermann, 2006) are intuitively invalid inferences like (1) whose premises involve non-specific readings of object DPs with a weak quantifier (e.g. *a secretary*, *a postdoc* in (1a/b)) or with a special quantifier (e.g. *something* in (1c); see Moltmann’s Sect. 12.1):

- (1) a. Smith is looking for  $[_{DP} \text{a secretary}]_{\text{non-specific}}$   
 b. Jones is looking for  $[_{DP} \text{a postdoc}]_{\text{non-specific}}$   


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 ≠ c. There is  $[_{DP} \text{something (viz. a staff member)}]_{\text{non-specific}}$  that Smith and Jones are (both) looking for  
 (≡ Smith and Jones are looking for the same (non-specific) thing)

In contrast to the reported intuition for (1) (viz. not valid), all mainstream contemporary semantics for reports with intensional transitive verbs (esp. Montague (1970) and Moltmann’s (1997) quantifier-based semantics and Zimmermann’s (1993, 2016) property-based semantics) counterintuitively predict inferences like (1) to be valid. This prediction is based on the upward monotonicity of the complement in (1a) and (1b) (in (2) resp. (3); see e.g. Moltmann, 2008, (78)) and on the possibility of existentially quantifying over the object DP in these reports (see (4)):

- (2) a. Smith is looking for  $[_{DP} \text{a secretary}]_{\text{non-specific}}$   
 b. All secretaries are staff members  


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 ⇒ c. Smith is looking for  $[_{DP} \text{a staff member}]_{\text{non-specific}}$   
 (3) a. Jones is looking for  $[_{DP} \text{a postdoc}]_{\text{non-specific}}$   
 b. All postdocs are staff members  


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 ⇒ c. Jones is looking for  $[_{DP} \text{a staff member}]_{\text{non-specific}}$   
 (4) a. Smith is looking for  $[_{DP} \text{a staff member}]_{\text{non-specific}}$   


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 ⇒ b. There is  $[_{DP} \text{something}]_{\text{non-specific}}$  that Smith is looking for

Since Montague- and property-based semantics assign the same interpretation to the occurrences of the DP *a staff member* in (2c) and (3c) (viz. the set of properties that are

values of attitudinal DPs with entities other than propositions (see e.g. Parsons, 1993; King, 2002), and distinguishes the semantic contribution and compositional behavior of CP- and DP-taking occurrences of attitude verbs (see e.g. Zimmermann, 2006).

<sup>2</sup>However, I do not believe that OTS provides the only solution to these problems. For a way out of these problems that does not adopt content individuals, the reader is referred to (Liefke, 2020a,b, to appear).

<sup>3</sup>There, this problem is called the *Monotonicity Problem*.

<sup>4</sup>According to Moltmann (2008), inferences like (1) are valid “only if the full inten[s]ional objects are the same” (p. 264).

simultaneously exemplified by some staff member resp. the property of being a staff member), they allow existential quantification over the two occurrences of this DP in the conjunction of (2c) and (3c) (in (5)). But this validates the unwanted inference to (1c).

- (5) Smith is looking for  $[_{DP} \text{a staff member}]_{\text{non-specific}}$  and Jones is looking for  $[_{DP} \text{a staff member}]_{\text{non-specific}}$

One may expect that OTS answers the above problem by referring to the dependence of intensional objects on the matrix attitude event – here: on Smith’s searching in @, i.e.  $e_1$ , resp. on Jones’ searching in @, i.e.  $e_2$  (see Moltmann, 2008, 2013a (Ch. 5) and Moltmann’s discussion of the function ‘att-obj’ in her Sect. 8). Given the non-identity of  $e_1$  and  $e_2$ , this dependence suggests that Smith’s search-object in @,  $\text{att-obj}(e_1)$ , is different from Jones’ search-object in @,  $\text{att-obj}(e_2)$ . The difference between these objects then blocks the joint quantification over the two occurrences of *a staff member* in (5), s.t. (1) comes out not valid. My OTS-reconstruction of this (presumed) argument is given in (6):

- (6) a.  $\llbracket \text{Smith is looking for } [_{DP} \text{a staff member}]_{\text{non-specific}} \text{ (viz. a secretary)} \rrbracket$   
 $= (\exists e_1) [\text{look-for}(e_1, \text{Smith}) \ \& \ \text{att-obj}(e_1) \in \llbracket \text{that there's [a staff mber]}_{\text{non-s.}} \rrbracket]$   
 $\equiv (\exists e_1)(\exists d_1) [\text{look-for}(e_1, \text{Smith}) \ \& \ d_1 = \text{att-obj}(e_1) \ \& \ d_1 \in \llbracket \text{that there is [a staff member]}_{\text{non-spec.}} \rrbracket]$
- b.  $\llbracket \text{Jones is looking for } [_{DP} \text{a staff member}]_{\text{non-spec.}} \text{ (viz. a postdoc)} \rrbracket$   
 $= (\exists e_2)(\exists d_2) [\text{look-for}(e_2, \text{Jones}) \ \& \ d_2 = \text{att-obj}(e_2) \ \& \ d_2 \in \llbracket \text{that there is [a staff member]}_{\text{non-spec.}} \rrbracket]$
- 
- $\Rightarrow$  c.  $\llbracket \text{Smith is looking for } [_{DP} \text{a staff member}]_{\text{non-spec.}} \text{ and Jones is looking for } [_{DP} \text{a staff member}]_{\text{non-spec.}} \rrbracket$   
 $= (\exists e_1)(\exists e_2)(\exists d_1)(\exists d_2) [\text{look-for}(e_1, \text{Smith}) \ \& \ \text{look-for}(e_2, \text{Jones}) \ \& \ d_1 = \text{att-obj}(e_1) \ \& \ d_2 = \text{att-obj}(e_2) \ \& \ d_1, d_2 \in \llbracket \text{that there is [a staff member]} \rrbracket]$
- 
- $\nRightarrow$  d.  $\llbracket \text{There is } [_{DP} \text{something}]_{\text{non-spec.}} \text{ that Smith and Jones are (both) looking for} \rrbracket$   
 $= (\exists e_1)(\exists e_2)(\exists d) [\text{look-for}(e_1, \text{Smith}) \ \& \ \text{look-for}(e_2, \text{Jones}) \ \& \ d = \text{att-obj}(e_1) \stackrel{!}{=} \text{att-obj}(e_2) \ \& \ d \in \llbracket \text{that there is [a staff member]} \rrbracket]$

The success of the above answer notwithstanding, it seems that – in analogy with her account of the sharing of semantic objects (see Moltmann’s Sect. 12.2) –, Moltmann would instead explain the non-validity in (1) through the fact that the intensional objects that are denoted by the object DPs in (1a) and (1b) have different (types of) satisfaction situations. In particular, for (1a) and (1b), these are (actual) situations that result from the seeker’s finding a secretary (see (1a)) resp. from the seeker’s finding a postdoc (see (1b)). The non-identity of these situations then explains the invalidity of (1).

A merit of Moltmann’s ‘satisfaction’-based explanation lies in its ability to account for the intuitive *validity* of inferences like (7) whose premises contain the same object DP (see also Moltmann, 2008, p. 264 ff.). This validity is based on the observation that the semantic objects of *look for* in (7a) and (7b) have the same type of satisfaction situations, viz. parametrized situations that result from a (parametric) seeker finding a student.

- (7) a. Williams is looking for  $[_{DP} \text{a student}]_{\text{non-specific}}$   
 b. Davis is looking for  $[_{DP} \text{a student}]_{\text{non-specific}}$
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- $\Rightarrow$  c. There is  $[_{DP} \text{some-(kind of )thing}]_{\text{non-specific}}$  that Williams and Davis are both looking for

However, the example in (7) also illustrates a potential problem for Moltmann’s approach: this problem lies in the fact that the conclusion in (1) is not (directly) based on the premises (1a) and (1b) (which feature different object DPs, viz. *a secretary* vs. *a postdoc*), but on the results (see (2c), (3c)) of applying upward monotonicity to these DPs. These

results feature the same object DP, viz. *a staff member*. Since the semantic objects that are denoted by the occurrences of this DP in (2c) and (3c) have the same type of satisfaction conditions, it seems that Moltmann’s account would need to take extra steps to explain the invalidity of the inference in (6). I would be interested to learn which steps Moltmann would consider. (Rejecting the upward monotonicity of *look for*-complements, which is suggested in (Moltmann, 2008, see p. 264), seems to me to be an expensive save.)

A related challenge for Moltmann’s approach concerns the intuitive validity of *imagine*-inferences like (8): since Moltmann assumes that the content individuals that are denoted by the object DPs of *imagine* (i.e. Moltmann’s *intentional objects*) generally<sup>5</sup> lack satisfaction conditions (see Moltmann, 2010, 2015b), she cannot – without further assumptions – explain the validity of (8) analogously to the validity of (7). Since Moltmann further excludes kinds of intentional objects (see Moltmann, 2015b), her account does not allow for an easy explanation of the validity of (8).<sup>6</sup>

- (8) a. Brown is imagining  $[_{DP} \text{a unicorn}]_{\text{non-specific}}$   
 b. Miller is imagining  $[_{DP} \text{a unicorn}]_{\text{non-specific}}$   


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 $\Rightarrow$  c. There is  $[_{DP} \text{some-(kind of )thing}]_{\text{non-specific}}$  that Brown and Miller are both imagining

It seems to me that the adoption of *kinds* of intentional objects – analogously to kinds of attitudinal objects (see Moltmann, Sect. 6, 12.2) – would account for the validity of (7) and (8) in a uniform way – and without reference to special meaning-shifts (as in Moltmann, 2015b). This account could identify such kinds with the output of Moltmann’s function ‘att-obj’ for input an event with a parametrized agent. For (8), this output would be the content individual that is associated with someone’s imagining (of) a unicorn, i.e.  $z$  imagines a unicorn in  $e$ , where  $z$  and  $e$  are a parametrized agent and a parametrized event, respectively. This output meets Moltmann’s two criteria for *kinds* of attitudinal objects, viz. sameness of the attitude (for (8a/b): imagining) and sameness of content (for (8a/b): ‘there is a unicorn’; see Moltmann, Sect. 6). The result would be a unified semantics for (7) and (8) (against arguments to the contrary from Moltmann, 2015b) that is conceptually simpler than Moltmann’s ‘satisfier’-account. (I will return to this point in Sect. 2.1.)

**1.2. Entailments between attitude reports with CP and DP complements.** I have argued above that OTS’ ability to block inferences to a common objective provides support for OTS over contemporary Hintikka-style semantics. Another intuitive advantage of OTS lies in its same-type interpretation of different-category attitude complements: OTS uniformly interprets direct object DPs and clausal complements of attitude verbs as properties of content individuals (type  $\langle e, t \rangle$ ; see Moltmann’s Sect. 8, 12). In virtue of this uniformity, it facilitates modelling the intuitive entailment relations between reports with DP and with CP complements (see e.g. Grzankowski & Montague, 2018; Liefke, 2019, to appear). An example of such entailment is given in (9):

- (9) a. John saw  $[_{INF} \text{Mary leave}]$   
 $\Rightarrow$  b. John saw  $[_{DP} \text{Mary}]$

Since the object DP, *Mary*, in (9b) is commonly taken to resist a propositional interpretation (see e.g. Forbes, 2006; Grzankowski, 2016; Zimmermann, 1993, 2016), possible-world semantics interprets DP- and CP-complements of attitude verbs in different semantic types. This strategy is even adopted for the complements of DP/CP-neutral verbs

<sup>5</sup>According to Moltmann (2010), the semantic objects of imagining only have satisfaction conditions [= conditions of representational adequacy] when imagining refers to actual situations.

<sup>6</sup>In her (2015b), Moltmann explains this validity through the ‘reinterpretation’ of the occurrence of *imagine* in (8a/b) as an intensional verb (i.e. along the lines of *need* and *look for*). She assumes that this reinterpretation is prompted by the use of the special quantifier *something* in (8c).

(e.g. *see*, *remember*, *imagine*) that – at least superficially – select for CPs as well as for (content *and non-content*) DPs (see e.g. Forbes, 2018). However, without the use of non-standard semantic mechanisms like type-shifting, this makes it difficult to account for entailments like (9).

In contrast to the above, OTS straightforwardly predicts the above entailment: this prediction only relies on the (plausible) assumption that the property of content-bearing objects  $\llbracket \text{that Mary leaves} \rrbracket$  is included in the property  $\llbracket \text{that Mary exists} \rrbracket$  (see (10b); cf. Moltmann’s (68b)):

- (10) a.  $\llbracket (9a) \rrbracket = (\exists e)[\text{see}(e, \text{John}) \ \& \ \text{att-obj}(e) \in \llbracket \text{that Mary leaves} \rrbracket]$  (see (25b))  
 b.  $\frac{(\forall d)[d \in \llbracket \text{that Mary leaves} \rrbracket \rightarrow d \in \llbracket \text{that Mary exists} \rrbracket]}{\neq \Rightarrow \text{c. } \llbracket (9b) \rrbracket = (\exists e)[\text{see}(e, \text{John}) \ \& \ \text{att-obj}(e) \in \llbracket \text{that Mary exists} \rrbracket]}$

*Note:* In light of the difficulties of turning OTS into a fully compositional semantics (see my Sect. 2.1), I would be curious about the mechanism that interprets the DP *Mary* in (9b) as the set of attitudinal/intensional objects with the content ‘Mary exists’.<sup>7</sup>

To capture the full entailment pattern of experiential attitude verbs (see Barwise, 1981; Barwise & Perry, 1983; Falkenberg, 1989; Liefke, to appear), Moltmann would further need to semantically distinguish between finite and non-finite attitude complements, against her fn. 13. In the absence of such distinction, OTS will be unable to explain the non-validity (in either direction) of entailments like (11) (see e.g. Barwise, 1981; Barwise & Perry, 1983; van der Does, 1991):

- (11) a. John saw  $[_{\text{INF}}$ Mary leave]  
 $\neq \neq$  b. John saw  $[_{\text{CP}}$ that Mary left]

**1.3. Parasitic attitudes and remembering the future.** Moltmann uses OTS to explain the equivalence of attitude reports with a CP- and a content DP-complement (see her Sect. 8). Examples of such equivalences are given in (12) and (13) (see Moltmann’s fn. 20 and (45)). Below, ‘att-obj(*e*)’ is the general property of being a concrete, content-bearing object:<sup>8</sup>

- (12) a. John thought  $[_{\text{CP}}$ that S]  
 $\equiv$  b. John thought/had  $[_{\text{DP}}$ the thought  $[_{\text{CP}}$ that S]]  $\underbrace{\text{comes for free with ‘think}(e)’}$   
 c.  $(\exists e)[\text{think}(e, \text{John}) \ \& \ \text{att-obj}(e) \in \llbracket \text{that S} \rrbracket \ \& \ \underbrace{\text{att-obj}(e) \text{ is a thought}}]$   
 $\equiv$   $(\exists e)(\exists d)[\text{think}'(e, \text{John}, d) \ \& \ \text{att-obj}(e) \in \llbracket \text{that S} \rrbracket \ \& \ d = \text{att-obj}(e) \ \& \underbrace{d \text{ is a thought}}]$   
 (13) a. John realized  $[_{\text{CP}}$ that S]  
 $\equiv$  b. John realized  $[_{\text{DP}}$ the fact  $[_{\text{CP}}$ that S]]  
 c.  $(\exists e)(\exists d)[\text{realize}'(e, \text{John}, d) \ \& \ \text{att-obj}(e) \in \llbracket \text{that S} \rrbracket \ \& \ d = \text{att-obj}(e) \ \& \underbrace{d \text{ is a fact in @}}]$   
 $\text{comes for free with ‘realize}(e)’$

In the above cases, the identity of the restrictor in the content DP (viz. *thought* resp. *fact*) is determined by the matrix attitude verb (in (12a): by the characterization of the event *e* – in dependence on which the attitudinal object is obtained – with a thinking event). As a result, the braced conjuncts in (12c) and (13c) come at no extra cost. However, as Moltmann shows in her Section 9, OTS also allows for the parasitic dependence

<sup>7</sup>The propositional extension of *Mary* with the predicate *exists* (in (10c)) is reminiscent of Parsons’ *Hamlet ellipsis*-account of imagination and depiction reports (see Parsons, 1997, pp. 375–376; cf. Liefke, 2020b).

<sup>8</sup>This generalization is required by Moltmann’s treatment of facts as (non-attitudinal) *modal* objects (see the end of her Sect. 9).

of the reported/‘matrix’ attitudinal object (e.g. the repetition-object in (14)) on other, contextually provided, content-bearing objects (there: on a claim; see (14b)).

- (14) a. John repeated [<sub>CP</sub>that it will rain]  
 ≡ b. John repeated [<sub>DP</sub>the claim [<sub>CP</sub>that it will rain]]  
 c.  $(\exists e)(\exists d)[\text{repeat}'(e, \text{John}, d) \ \& \ \text{att-obj}(e) \in \llbracket \text{that it will rain} \rrbracket \ \& \ d \in \llbracket \text{that it will rain} \rrbracket \ \& \ d \text{ is a claim}]$

I conjecture that the dependence of attitudinal objects on other, contextually determined content individuals can be used to resolve seeming challenges for the *ambiguity approach* to the above equivalences (see e.g. Asher, 1993; Parsons, 1993; King, 2002, 2007). The latter approach explains the equivalences in (12) and (13) through the particular lexical-selectional profile of the matrix attitude verbs. This profile restricts *realize* to real-world facts and restricts *remember* to past real-world facts (relative to the time-parameter of the evaluation index). The ambiguity approach is challenged by seeming counterexamples like (15a), in which a past-oriented factive verb (to use Moltmann’s terminology from her (2013a)) takes a future-directed – and, hence, non-factive – complement:

- (15) *Context*: Anna is about to invite her neighbor for coffee when she hesitates:  
 a. She suddenly remembers [<sub>CP</sub>that she is going to do a volunteer shift at the hospital]  
 ≡ b. She suddenly remembers [<sub>DP</sub>her (previously made) plan [<sub>CP</sub>(that she is going) to do a volunteer shift at the hospital]]

OTS could answer this counterexample by assuming that the clausal complement in (15a) characterizes – next to the matrix attitudinal object – a contextually provided intensional object (in (15b): Anna’s previously made plan; see Moltmann’s Sect. 12). This assumption is supported by the intuitive equivalence of (15a) with (15b). Since plans are content individuals that originate/‘are made’ in the past (but are directed at the future), they are in accordance with the restriction of *remember* to past objects, events, or states. The OTS-style<sup>9</sup> interpretation of (15a/b) (in (16)) captures this move:

- (16)  $(\exists e)(\exists d)[\text{remember}'(e, \text{Anna}, d) \ \& \ \text{att-obj}(e) \in \llbracket \text{that Anna is going to do a volunteer shift} \rrbracket \ \& \ d \in \llbracket \text{that Anna is going to do a volunteer shift} \rrbracket \ \& \ d \text{ is a plan}]$

Admittedly, the above answer still owes a story about the identification of the particular *kind* of attitudinal or intensional object (above: a plan) on which the matrix attitudinal object is parasitic. I follow Moltmann’s suggestion (from the subsequent paragraph of her (35)) that this object is contextually determined by the matrix attitude event (above: Anna’s remembering in @). In particular, following Moltmann’s conjecture about the functional relation, att-obj, between attitude events and their matrix attitudinal objects (above: a mnemonic object), one might assume that an analogous relation holds between attitude events and their parasitic content individuals (above: a plan).

It is a topic for future research whether this move generalizes to other seeming counterexamples to the ambiguity approach, e.g. to fearing or imagining the past (see (17a/b)), and to what extent the tense and mood of the embedded verb are indicative of the satisfaction of the verb’s selectional restrictions. In (17a) (resp. (17b)), this challenge arises from the combination of a future- (or possibility-) oriented verb (here: *fear* resp. *imagine*; see Moltmann, 2013a, p. 128) with a past-tense complement:

- (17) *Context*: John was supposed to meet Eva for dinner over an hour ago, but he still has not arrived.  
 a. I fear [<sub>CP</sub>that he was in an accident]

<sup>9</sup>In this interpretation, we deviate from Moltmann’s (37) in treating *d* as an existentially bound variable.

( $\stackrel{?}{\equiv}$  I fear  $[_{DP}$ a past realization of the (for me still open) epistemic possibility  $[_{CP}$ that he was in an accident])

b. I imagine  $[_{CP}$ (that) he was held up by a student in need]

This completes my supplementary support for OTS *vis-à-vis* Hintikka-style relational semantics. A critical examination of this support leads one to conjecture<sup>10</sup> that a large share of OTS’ merits is due to the availability of content individuals alone (possibly enriched with their respective satisfaction conditions), rather than to the *integration* of content individuals into truthmaker semantics. This conjecture is further supported by the compositional spell-out of OTS, as I will show in the next section:

## 2. TOWARDS COMPOSITIONAL OBJECT-BASED TRUTHMAKER SEMANTICS

Moltmann starts her paper with the caveat that it will “just present the general ideas for a compositional semantic analysis of the relevant data, rather than fully elaborating such an analysis itself”. I agree that – especially in the early developmental phase of a new semantic theory – it is important to focus on core ideas and motivations. However, I believe that the compositional development of a semantics often brings out issues that are otherwise easy to overlook. I will show below that this is also the case for OTS: specifically, the compositional development of OTS raises a question about OTS’ added value over a truthmaker-semantic supplementation of Kratzer’s (2006) modifier-analysis of clausal attitude complements (see my Sect. 2.1) and about its utility for the resolution of certain problems of the Relational Analysis (see my Sect. 2.2).

**2.1. Basic compositional OTS.** OTS distinguishes itself from standard, relational attitude semantics by interpreting attitude complements as predicates of content individuals. (These predicates modify content individuals by specifying their truthmaking or satisfaction conditions; see Moltmann’s Sect. 6, 8). However, the resulting interpretation of clausal complements (*viz.* as extensional properties of individuals, type  $\langle e, t \rangle$ ; see Moltmann’s (29)) has a different type from the truthmaker-interpretation of sentences and TPs (type  $\langle s, t \rangle$ ; see Fig. 1). In particular, if sentences and TPs are interpreted as sets of truthmaking situations (as is suggested in Moltmann’s survey of sentence-based truthmaker semantics; see her Sect. 4), the interpretation of attitudinally embedded CPs as properties of content individuals blocks the familiar interpretation of the complementizer as a (semantically vacuous) function from sets of worlds, or of situations, to themselves.

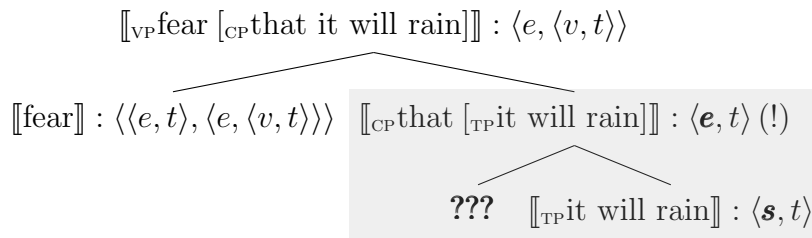


FIGURE 1. A type-mismatch between the type of the TP and the CP.

As one would expect, the needed type-shift can be attributed to the lexical semantics of the complementizer *that* (in (18)), which is then assigned the type  $\langle \langle s, t \rangle, \langle e, t \rangle \rangle$  (cf.

<sup>10</sup>This conjecture is based on the observation that OTS’ ability to answer the challenges from Sect. 1.1–1.3 is largely due to the availability of content individuals, and does not rely on the particular satisfaction conditions of these individuals.

Moulton, 2009, (20) on p. 28).<sup>11</sup> This semantics is a  $p$ -abstracted version<sup>12</sup> of Moltmann’s OTS for attitude complements (see Moltmann’s (29)), where  $p$  and  $x$  range over sets of satisfaction situations and over attitudinal objects, respectively. Below, I assume that  $p := \{s \mid s \Vdash S\}$  and that  $\bar{p} := \{s \mid s \nVdash S\}$ , for  $S$  a TP (see Moltmann’s Sect. 4):

$$(18) \quad \llbracket \text{that} \rrbracket = \lambda p. \{x \mid \forall s. s \Vdash x \rightarrow (\exists s'. s' \in p \ \& \ s' < s) \ \& \ (\forall s'. s' \in p \rightarrow (\exists s. s \Vdash x \ \& \ s' < s)) \ \& \ (\exists s. s \nVdash x \rightarrow (\forall s'. s' \in \bar{p} \rightarrow s' \nVdash x))\}$$

The resulting OTS-interpretation of *John fears that it will rain* (see Moltmann’s (18a)) is given in Figure 2. This figure adopts the complex (!) abbreviation in (19):

$$(19) \quad \boldsymbol{\vartheta} := (\forall s. s \Vdash \text{att-obj}(e) \rightarrow (\exists s'. s' \Vdash \text{it will rain} \ \& \ s' < s) \ \& \ (\forall s'. s' \Vdash \text{it will rain} \rightarrow \exists s. s \Vdash \text{att-obj}(e) \ \& \ s' < s)) \ \& \ (\exists s. s \nVdash \text{att-obj}(e) \rightarrow (\forall s'. s' \nVdash \text{it will rain} \rightarrow s' \nVdash \text{att-obj}(e)))$$

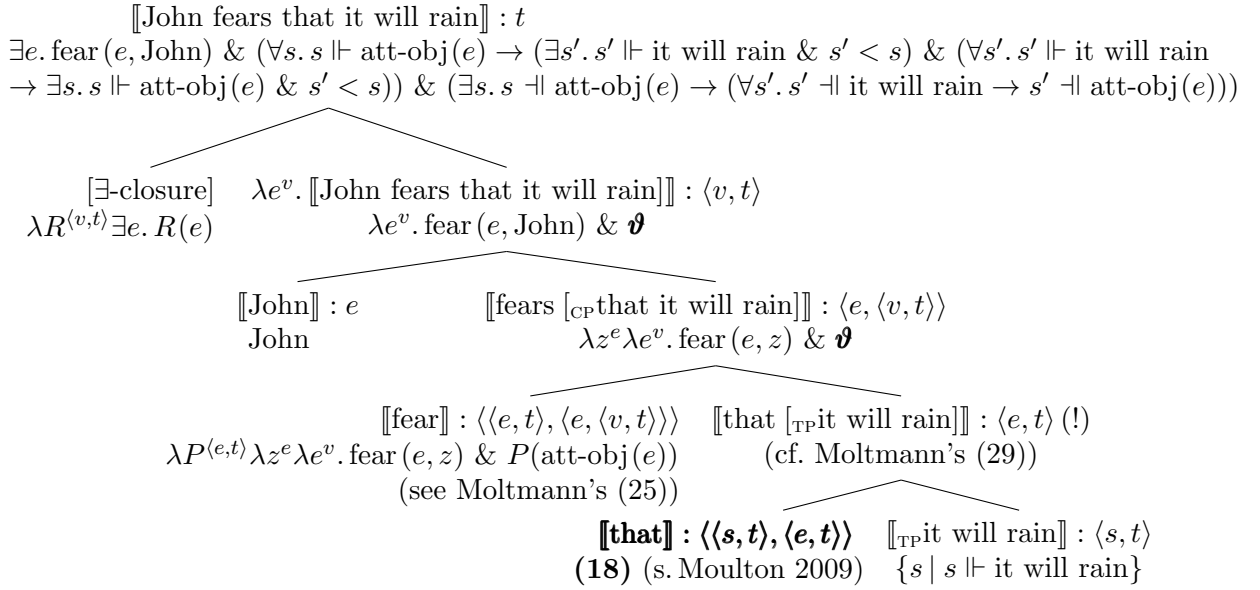


FIGURE 2. A compositional OTS-reconstruction of Moltmann’s (18a).

The semantics in Figure 2 is a fully compositional interpretation of Moltmann’s (18a). However, given the complex semantics of the complementizer *that* (see my (18)) – and the attendant difficulty of doing day-to-day compositional semantics in OTS –, I wonder whether the merits of OTS can be preserved by merely *supplementing* (but without fully *integrating*) content individuals with their Moltmann-style truthmaking conditions.<sup>13</sup> In what follows, I call the resulting – simpler, non-integrated – semantics *object-based semantics with truthmaking*, abbreviated ‘OS+T’.<sup>14</sup>

<sup>11</sup>This differs from (Moltmann, 2013a, pp. 189–190, see esp. (58)), which (indirectly) attributes this type-shift to the semantics of the matrix attitude verb (here: *fear*). However, this move fails to capture the property-interpretation of clausal complements (in the type  $\langle e, t \rangle$ ).

<sup>12</sup>This version arises from the replacement of the sentence- or TP-variable  $S$  by the truthmaking conditions for  $S$ . As a result, (18) replaces ‘ $s \Vdash S$ ’ by ‘ $s \in p$ ’ in Moltmann’s (29) (and analogously for  $s \nVdash S$ ).

<sup>13</sup>*Note:* Moltmann excludes Kratzer/Moulton-style semantics with reference to the fact that “[this semantics] treats content bearers with the force of possibility and with the force of necessity exactly the same” and, hence, “makes it impossible to account for the connections between attitude reports and modals” (see the final paragraph of her Sect. 8). However, since the satisfaction conditions of content individuals can be specified on the basis of these objects alone (see my remarks above), I conjecture that Kratzer/Moulton’s semantics can be straightforwardly extended to answer Moltmann’s objection.

<sup>14</sup>It seems to me that Moltmann’s Nominalization Theory (see Moltmann, 2008, 2013a: Sect. 5) is an early version of OS+T.



The key difference between Moltmann’s OTS and my proposed OS+T lies in whether attitude complements are interpreted as directly specifying the truthmaking conditions (in OTS; see Moltmann) or as only directly specifying the propositional content of the attitudinal objects that are denoted by these complements (in OS+T; see Kratzer, 2006; Moulton, 2009, 2015). Since the truthmaking conditions of attitudinal objects specify these objects’ content (see Moltmann’s semantics for attitude complements in (28)–(29)), OS+T is strictly weaker than OTS. The possibility of doing with OS+T alone is supported by the observation that the reported attitudinal objects “come with inherent satisfaction or realization conditions” (see Moltmann’s Sect. 7.2)<sup>15</sup> and that – in the presented version of OTS – these conditions are not influenced by the compositional semantic process. As a result of the latter, these conditions can be retroactively specified ‘without loss’.

The use of OS+T is further supported by the observation that only OS+T – but not OTS – enables a uniform semantics for intensional attitude reports (e.g. Moltmann’s (18a) & the *look for*-report in (1a)) and intentional attitude reports (e.g. the *imagine*-report in (8a)): since intentional objects typically lack satisfaction conditions (see Moltmann, 2010, 2015b; repeated in my Sect. 1.1), OTS would require that *fear* (or *look for*) and *imagine* select for different kinds of *that*-clauses (with different lexical entries for ‘truthmaker-introducing’ and ‘non-truthmaker-introducing’ *that*). (This different selection owes itself to the fact that Moltmann’s semantics for the complementizer (in (18)) incorporates truthmaking conditions into the semantics of *that*.) The introduction of content individuals by the matrix attitude verb (see the semantics of *fear* in Figure 3) avoids a polysemic *that*: this introduction provides truthmaking conditions only for those content individuals that intuitively have such conditions. This is the case for fear-/search-objects, but not for imagination-objects.

My proposed OS+T semantics for Moltmann’s (18a) is given in Figure 3. This semantics uses the Kratzer/Moulton-style interpretation of the complementizer *that* from (20). (This interpretation is an extensional variant of Moltmann’s (34a), which she attributes to Moulton (2015).) In (20),  $\mathcal{F}_{cont}$  is a content-related domain projection function that identifies the propositional content of a content individual (see e.g. Kratzer, 2006, 2013). For example, for John’s fear(-in-@) that it will rain, this function yields the proposition that it will rain (or, in our case: the set of situations that make ‘it will rain’ true).

$$(20) \quad \llbracket \text{that} \rrbracket = \lambda p^{(s,t)} \lambda x^e [\mathcal{F}_{cont}(x) = p]$$

Interestingly, the semantics in Figure 3 largely shares Moltmann’s motivation for OTS (see her Sect. 7). In particular, by replacing propositions by concrete, content-bearing objects as the targets of mental attitudes, OS+T avoids the attendant problems of the Relational Analysis of attitude reports (see Moltmann’s Sect. 5, 7.1). At the same time, OS+T still gives a semantics of mental objects<sup>16</sup> (see Sect. 7.2; cf. Moltmann, 2013a,b) and allows for the underspecification of content by the complement clause (see Sect. 7.5). Since OS+T still assumes modal objects like permissions (*vis-à-vis* deontic states) – and since attitudinal objects are still chosen in dependence on the external attitude event (in Fig. 2, 3: John’s fearing event in @; see the function ‘att-obj’) –, this semantics even ensures the dependency of truthmakers on attitudinal and modal objects (see Sect. 7.3, 7.4).

Admittedly, since OTS – unlike OS (without T) – *explicitly* specifies the truthmaking conditions of content individuals, it may still be argued that only OTS can provide an adequate semantics for modal, obligation, and permission sentences (see my caveat in the introduction to these comments, and the final paragraphs in Moltmann’s Sect. 8). How-

<sup>15</sup>In a similar vein, Moltmann notes that “it may depend on the particular attitudinal or modal object what the satisfiers in question are” (see her Sect. 7.3).

<sup>16</sup>Thus, DPs of the form ‘the  $[_N]$   $[_{CP}$  that  $[_{TP}]$ ’ are interpreted as content individuals (see my Sect. 2.2).

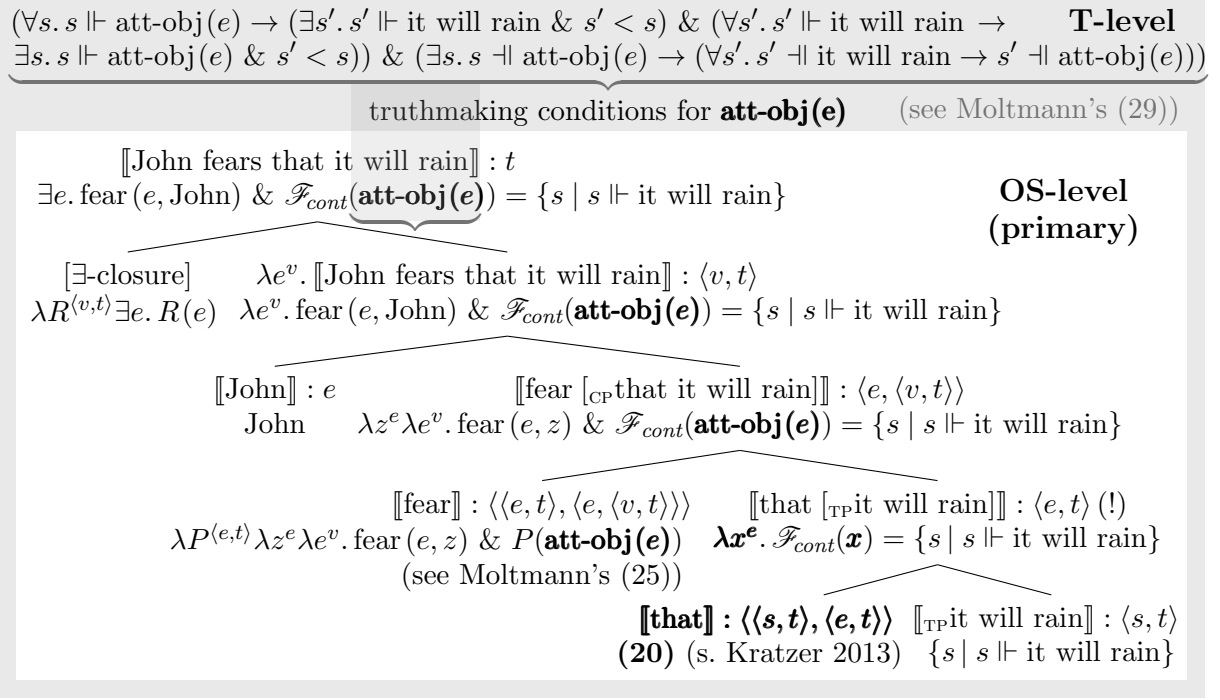


FIGURE 3. A compositional OS+T-reconstruction of Moltmann's (18a).

ever, since the majority of attitudinal objects (incl. hopes, beliefs, and epistemic modal objects) does not intuitively come with such inherent conditions (Moltmann admits this in Sect. 7.3), it is questionable whether this warrants a generalization along the lines exemplified in Figure 2. At least for practical (= day-to-day compositional semantic) purposes, it may make more sense to adopt OS (without T) as the basic case, and reserve the extension with the objects' satisfaction conditions (resulting in OS+T) to specific kinds of objects and lexical triggers (e.g. modals, permission predicates).

The adoption of a two-stage setup (viz. always adopt content individuals; consider their truthmaking conditions only when required) is further supported by the observation that the majority of Moltmann's challenges for possible world-style Hintikka semantics can be answered by the adoption of content individuals alone. The attitudinal phenomena that do *vis-à-vis* those that do not require the specification of truthmaking conditions are contrasted in Table 1.

The above considerations have focused only on the compositional implementation of OTS for *that*-clause attitude reports. To see the full scope of Moltmann's account – and the challenge that is posed by the objectivization effect (see my intermittent remark at the beginning of Sect. 1) –, I now turn to the compositional semantics of attitude reports with content DP complements.

**2.2. Attitude complements as contents *vis-à-vis* as objects.** Moltmann motivates her use of OTS by its ability to distinguish between the content and the object of an attitude (see Moltmann's Sect. 5, [1]). This distinction is obtained through the different roles of attitudinal objects and is the driving force behind the objectivization effect. The latter describes a shift in the reading of the attitude verb that changes this reading from a reading in which the semantic value of the complement serves as the *content* of the reported attitude (see (21a)) to a reading in which the semantic value of the complement serves as the *object* towards which the attitude is directed (see (21b); cf. Pietroski, 2000; Moltmann, 2003, 2008, 2013a; Forbes, 2018). The objectivization effect is illustrated in (21) (see Moltmann's (18)):

Phenomena that <b>only</b> require <b>OS</b>	Phen'a that <b>require</b> <b>OTS (or OS+T)</b>
<ul style="list-style-type: none"> <li>• philos. problems w. propositions (§ 7.1)</li> <li>• Prior's substitution problem (§ 5 [3])</li> <li>• the objectivization effect (§ 5 [3]; see my Sect. 2.2)</li> <li>• subject matter of a sentence (§ 4)</li> <li>• partiality of content (§ 4, § 6.2 [3])</li> <li>• the semantics of content DPs (<i>John's request that S</i>; § 5 [4]; see Moulton, 2009)</li> <li>• the semantics of special quantifiers (e.g. <i>something</i>; § 5 [5]; see Elliott, 2016)</li> <li>• underspecification of content by the CP (§ 7.5; see Liefke &amp; Werning, 2018)</li> <li>• parasitism of attitud'l objects on other content individuals (§ 9; my Sect. 1.3)</li> <li>• non-inferences to a common objective (my Sect. 1.1)</li> <li>• entailments between reports with DP &amp; with CP complements (my Sect. 1.2)</li> </ul>	<p>see Moltmann's Sect. 13 (Summary):</p> <ul style="list-style-type: none"> <li>• the distinction between strong and weak permission (§ 7.4)</li> <li>• connections between attitude reports &amp; modal sentences (§ 8, § 11.1)</li> <li>• harmonic modals and modal concord (§ 11.2)</li> <li>• causal connections between an object &amp; its satisfiers (see § 12.1; cf. § 6.1)</li> <li>• cross-attitudinal quantification (§ 12.2; see Moltmann, 2008; 2013a, Ch. 5)</li> </ul>

TABLE 1. Applications of content individuals *vis-à-vis* of their satisfaction conditions.

- (21) a. John fears [<sub>CP</sub>that it will rain]  
 [≡ John's fearing has as its *content* (the proposition) that it will rain]  
 ≠ b. John fears [<sub>DP</sub>the proposition [<sub>CP</sub>that it will rain]]  
 [≡ John's fearing has as its *object* the proposition that it will rain]

Moltmann's semantics for reponse-stance and factive verbs (see her Sect. 9) leads one to expect that the objectivization effect lies in the shift from a binary-relation interpretation (in (22a)) to a ternary-relation interpretation of *fear* (in (22b)).<sup>17</sup> In contrast to the former, the latter contains the attitudinal object as an explicit argument:

- (22) a.  $(\exists e)[\text{fear}(e, \text{John}) \ \& \ \text{att-obj}(e) \in \llbracket \text{that it will rain} \rrbracket]$   
 b.  $(\exists e)(\exists d)[\text{fear}'(e, \text{John}, d) \ \& \ \mathbf{\text{proposition}(d)} \ \& \ d \in \llbracket \text{that it will rain} \rrbracket]$

However, apart from leaving open the question of how (22b) comes about, this strategy seems unable to block the interpretation of (21a) as (23): since the resulting semantics also interprets the occurrence of *fear* from (21a) as a ternary relation, it is unable to explain the observed shift in reading in (21).

- (23)  $(\exists e)(\exists d)[\text{fear}'(e, \text{John}, d) \ \& \ d = \mathbf{\text{att-obj}(e)} \ \& \ d \in \llbracket \text{that it will rain} \rrbracket]$

The above does not imply OTS' inability to capture the objectivization effect. Rather, it shows the need to acknowledge that different semantic mechanisms are at play in (21b) *vis-à-vis* (21a). In particular, following Elliott (2016), I propose that, while the complement *that*-clause in (21a) is interpreted as a modifier of the reported fearing-event, the complement DP in (21b) is interpreted as an additional argument of the verb (see Fig. 5). The 'modifier' interpretation of (21a) is given in Figure 4. There, '*fear<sub>cont</sub>*' is the content-reading of *fear*:

<sup>17</sup>This expectation is further supported by her remark that "the attitudinal objects analysis [...] avoids the Substitution Problem and the Objectivization Effect by not taking clausal complements to be referen-

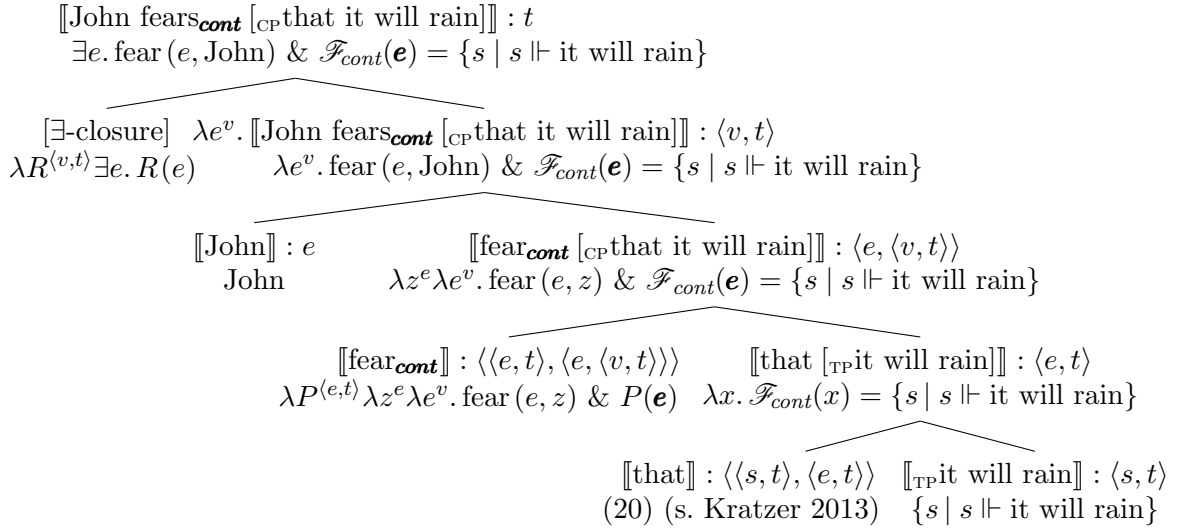


FIGURE 4. A compositional OS-reconstruction of (18a)/(21a) (ff. Elliott, 2016).

Like Moltmann’s and our simplified semantics for (18a) (see Fig. 2, 3), Figure 4 interprets *fear* as a function that takes as input a property of content individuals (here:  $\llbracket \text{that it will rain} \rrbracket$ ) and an individual (here: John), and produces as output a set of events.<sup>18</sup> However, in contrast to Moltmann’s semantics (but in line with her semantics from (Moltmann, 2015b, (25))), Figure 4 attributes the property  $\llbracket \text{that it will rain} \rrbracket$  not to a content individual that is associated with the event (in Fig. 2, 3:  $\text{att-obj}(e)$ ) but to the event itself<sup>19</sup> (or to the product of this event; see Moltmann, 2013a,b, 2017b). *That*-clauses are thus treated as predicates of the Davidsonian event argument. The treatment of events as content individuals is defended in (Hacquard, 2006). To make this treatment possible, I allow that the variable  $x$  in Figure 4 ranges over events.

The application of the property  $\llbracket \text{that it will rain} \rrbracket$  to the reported event obviates the introduction of further content individuals at any point in the semantic composition. This differs from the interpretation of (21b): in this interpretation, the type-mismatch between the DP *the proposition that it will rain* and the interpretation of the content-reading of *fear* (see Fig. 4) – and the type-match between this DP and the object-interpretation of *fear*, i.e.  $\text{fear}_{\text{obj}}$  – triggers the selection of the object-reading. The interpretations of the content- and the object-reading of *fear* are contrasted in (24). There, the relevant type-difference is marked in boldface:

- (24) a.  $\llbracket \text{fear}_{\text{cont}} \rrbracket = \lambda P^{(e,t)} \lambda z^e \lambda e^v [\text{fear}(e, z) \ \& \ e \in P] \quad (\text{type } \langle \langle \mathbf{e}, \mathbf{t} \rangle, \langle e, \langle v, t \rangle \rangle \rangle)$
- b.  $\llbracket \text{fear}_{\text{obj}} \rrbracket = \lambda x^e \lambda z^e \lambda e^v (\exists d^e) [\text{fear}'(e, z, d) \ \& \ d = x] \quad (\text{type } \langle \mathbf{e}, \langle e, \langle v, t \rangle \rangle \rangle)$   
 $\equiv \lambda x^e \lambda z^e \lambda e^v [\text{fear}'(e, z, x)], \text{ where } x \notin \bigcup \{\text{Event}, \text{State}\}$

In Figure 5, the interpretation of the DP *the proposition that it will rain*, i.e.  $(\iota x^e) [\text{proposition}(x) \ \& \ \mathcal{F}_{\text{cont}}(x) = \{s \mid s \Vdash \text{it will rain}\}]$ , is obtained from the interpretation of the CP *that it will rain* (i.e.  $\lambda x^e. \mathcal{F}_{\text{cont}}(x) = \{s \mid s \Vdash \text{it will rain}\}$ ) and the interpretation of the content noun *proposition* (i.e.  $\lambda x. \text{proposition}(x)$ ; see Potts, 2002; Moulton, 2009) through Kratzer & Heim’s (1998, p. 65) rule of Predicate Modification (abbr. ‘PM’).

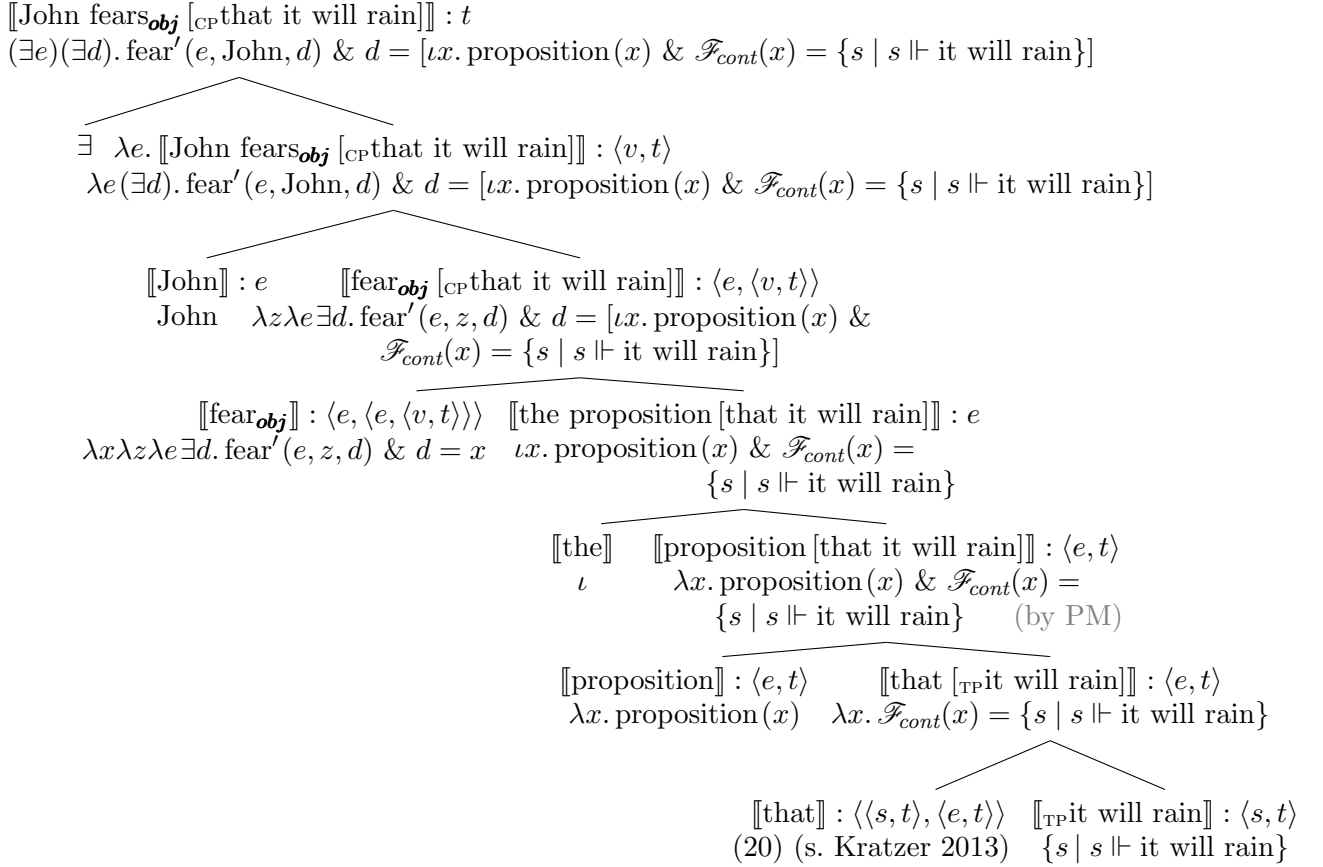


FIGURE 5. A compositional OS-reconstruction of (21b) (ff. Elliott, 2016).

Since  $\text{fear}_{\text{cont}}$  stands in no *prima facie* semantic relation to  $\text{fear}_{\text{obj}}$ , there is not entailment between (21a) and (21b), as desired.

Note that the above explanation of the objectivization effect cannot be undermined by a variant of the strategy from (23) that interprets *fear* in (21a) as  $\text{fear}_{\text{obj}}$ : our explanation blocks this strategy by restricting the third argument position of  $\llbracket \text{fear}_{\text{obj}} \rrbracket$  to content individuals that are not events or states (see (24b)). The equivalence of (21a) with (25a) – and the attendant absence of the objectivization effect in (25) – is then explained by assuming that the interpretation of the third argument is relative both to the verbal root (see Elliott, 2016)<sup>20</sup> and to the identity of the kind of content individual that is denoted by the DP complement (i.e. to its classification as, e.g., a proposition, a fact, or a possibility). The latter is captured by postulates of the form of (P) (see Forbes, 2018):

- (25) a. John fears  $[\text{CP that it will rain}]$  (see (21a))  
 $\equiv$  b. John fears  $[\text{DP the possibility} [\text{CP that it will rain}]]$   
 $\equiv$  John's fearing has as its *content* (the proposition) that it will rain

$$\begin{aligned}
(\mathbf{P}) \quad & (\forall z)(\forall p)(\forall e)[(\text{fear}'(e, z, \iota x. \text{possibility}(x) \ \& \ \mathcal{F}_{\text{cont}}(e) = p)) \\
& \equiv (\text{fear}(e, z) \ \& \ \mathcal{F}_{\text{cont}}(e) = p)]
\end{aligned}$$

tial terms providing an argument of the relation expressed by the embedding verb" (Moltmann, 2017a, p. 6).

<sup>18</sup>This differs from Elliott (2016), who interprets attitude verbs like *fear* in the type  $\langle e, t \rangle$ . Our choice of a different-type interpretation is motivated by the wish to stay as close as possible to Fig. 2 and 3.

<sup>19</sup>Indeed, Moltmann makes this suggestion for modal objects in her Sect. 8, where she proposes to "Take the modal object to be the event argument itself".

<sup>20</sup>Thus, different verbs make different assumptions about the relation between the argument and the propositional content of the eventuality introduced by the verb.

I doubt that the above is the only possible OTS-style explanation of the objectivization effect. However, it shows that, in order to account for this effect, a more elaborate story needs to be told than the one that is currently provided by Moltmann.

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