

## Preliminaries for a substitution theory of *de re*\*

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**Abstract** We examine whether several challenges for transparent evaluation theories of *de re* can be accounted for by a single mechanism of propositional substitution. We provide necessary conditions for replacing the prejacent of an attitude with another salient proposition, and review some merits and weaknesses of this approach.

**Keywords:** intensionality, *de re*, third readings, attitude reports, substitution

### 1 Introduction

Sentence (1) is at least three way ambiguous. On its *de dicto* reading, (1) is true if Mary wants it hold that she and Sue have the same kind of hat, whatever it may be. The features of the hat Sue actually owns play no role in determining the truth of this reading. On its *de re* reading, (1) is true if there is a specific hat like Sue’s (say, both are red caps) such that Mary desires to have *that* hat. Finally, Fodor (1970) observed a *third* reading on which (1) does not assert the existence of a particular hat, but rather, that Mary desires some hat from a group of hats who are all similar to the hat Sue has (i.e., Mary thinks, ‘I’ll buy a red cap!’ while, possibly unbeknownst to her, Sue has a red cap). On these latter two readings, (1) is only true if the hat or the kind of hat Mary desires correlates with the way Sue’s hat actually is.

(1) Mary wants to buy a hat like Sue’s. (Fodor 1970)

*Transparent evaluation* (henceforth, TE) theories of intensionality derive *de re* and *third* readings of attitude reports by interpreting a world-dependent element in the attitude’s propositional complement relative to the matrix world of evaluation, while interpreting the rest of the complement in the worlds quantified over by the attitude (e.g., Percus 2000; Keshet 2010). In the case of (1), the NP *hat like Sue’s* is evaluated relative to actuality on both the *de re* and *third* readings, which differ only in the quantificational scope of the DP that hosts that NP relative to the verb *want*. As defined in (2), TE theories are those that derive, in addition to the truth-conditions in (3a) for the *de dicto* reading of (1), those in (3b-c) for its *de re* and *third* readings.

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- (2) For any sentence dominating a DP  $\delta$  s.t.  $\delta = [D \text{ NP}]$  and an intensional operator  $\omega$ , TE theories generate the readings in (a-c) (in which  $>$  designates scopal relations), as long as  $\delta$  is not embedded in a scope island.
- a. *de dicto*:  $\omega > \delta$ , and NP is evaluated in the worlds quantified over by  $\omega$ .
  - b. *de re*:  $\delta > \omega$ , and NP is evaluated in the matrix world of evaluation.
  - c. *third*:  $\omega > \delta$ , and NP is evaluated in the matrix world of evaluation.
- (3)
- a.  $\lambda w. \forall w' \in \text{DESIRE}_{\text{Mary},w}: \exists x: \text{hat-like-Sue}'s_{w'}(x) \wedge \text{buy}_{w'}(\text{Mary},x)$  *de dicto*
  - b.  $\lambda w. \exists x: \text{hat-like-Sue}'s_w(x) \wedge \forall w' \in \text{DESIRE}_{\text{Mary},w}: \text{buy}_{w'}(\text{Mary},x)$  *de re*
  - c.  $\lambda w. \forall w' \in \text{DESIRE}_{\text{Mary},w}: \exists x: \text{hat-like-Sue}'s_w(x) \wedge \text{buy}_{w'}(\text{Mary},x)$  *third*

Over the years, a body of evidence that challenges TE theories has emerged, indicating that TE is insufficient; attitude reports have true readings that are distinct from each reading derivable via TE (2). This suggests that, at the very least, we should supplement TE with a mechanism that derives the remaining readings.

The very modest goal of this paper is to consider a group of problematic examples and evaluate the possibility that a single mechanism accounts for them all. We consider, in particular, a mechanism suggested by Percus (2020), which licenses substitution of the prejacent of an attitude verb with another contextually salient proposition, as long as certain conditions on the relation between the two propositions are met. As its title indicates, this paper presents a preliminary evaluation of this kind of approach to the recalcitrant data. It should thus be conceived of as a progress report, examining what constraints a substitution mechanism should obey if it is to play a role in a theory of *de re*, and presenting novel data pertinent to this question.

We proceed as follows: Section 2 reviews the challenges to TE that will concern us. Section 3 introduces a mechanism for propositional substitution, while section 4 posits necessary constraints on this mechanism. Section 5 introduces new empirical challenges that a satisfactory substitution theory should address. Section 6 concludes.

## 2 Transparent evaluation and its discontents

### 2.1 Problem #1: *Double-vision* and descriptive readings of singular terms

Quine (1956) has already illustrated that *de re* cannot reduce to scoping above an intensional environment as in (2b). In his *double-vision* context (4), (4a) is true and can be paraphrased, roughly, with (4b), read *de dicto*. Assuming names like *Ortcutt* are non-quantificational, rigid-designators (i.e., denote the same individual in every world; Kripke 1980) and that belief is closed under conjunction, under TE theories (4a) only ascribes to Ralph the contradictory belief that *Ortcutt is and is not a spy*.

The problem is not confined to rigid-designators in intensional environments. Other singular terms under attitudes, e.g., definite descriptions, also give rise to

readings that do not correspond to any of the readings derivable via TE.<sup>1</sup> These cases are often generated by positing an additional mechanism, which effectively allows us to interpret a report ascribing to  $x$  some attitude towards a prejacent  $\phi$  if  $x$  holds the attitude towards the proposition derived by replacing a singular term in  $\phi$  with a salient descriptor that is co-extensional with the singular term in the actual world.<sup>2</sup>

- (4) Context: Ralph sees the same man on two different occasions – one at the beach and one in the town hall – but fails to recognize that the man at the beach is the same man as the one in the town hall, Bernard J. Ortcutt.
- a. Ralph believes that Ortcutt is a spy and he believes that Ortcutt is not a spy.
  - b. Ralph believes that the man at the beach is a spy and he believes that the man in the town hall is not a spy.

## 2.2 Problems #2-3: Empty-extension *third* readings and *de re* predicates

Quine showed that *de re* does not reduce to scoping out of an intensional environment, contra (2b). Kaufmann (Schwager 2009) shows that *third* readings do not reduce to shifting the world index of a DP inside an intensional environment, contra (2c). Given the context in (5), the utterance in (5a) is felicitous and seems to convey what a *de dicto* reading of (5b) does.

- (5) Context: Mary is looking at the Burj Dubai (henceforth, BD). Not knowing that it has 191 floors and is the world's highest building, she thinks, 'I want to buy a building that's a floor higher!'
- a. Mary wants to buy a building with 192 floors.
  - b. Mary wants to buy a building that is one floor higher than BD.
  - c.  $\lambda w. \forall w' \in \text{DESIRE}_{\text{Mary},w}[\exists x: \text{has-192-floors}_w(x) \wedge \text{buy}_{w'}(\text{Mary}, x)]$

However, since there is no specific building Mary wants to buy, the DP *a building with 192 floors* in (5a) must scope below the attitude verb *want*, while its NP restrictor must not be evaluated in the intensional context, as Mary (by assumption) does not know how many floors BD has. Under TE, this leaves us with the *third* reading, formalized in (5c). But the proposition in (5c) is one according to which Mary desires the contradiction  $\exists x \in \emptyset$  to hold, as there is no building with 192 floors in the matrix evaluation world.

Here is a related problem: Sudo (2014) noticed that predicates, too, seem to have *de re* readings that TE cannot generate. For instance, in the context of (6), (6a) is

<sup>1</sup> We omit further examples for conciseness; consult Sæbø 2015 for an instructive body of data.

<sup>2</sup> Such mechanisms date back to Kaplan 1968; Lewis 1979; Cresswell & Von Stechow 1982, with more recent implementations in, e.g., Percus & Sauerland 2003; Aloni 2005; Maier 2009; Sæbø 2015.

true, and can be paraphrased with (6b). Yet TE theories only allow us to shift the evaluation world of restrictors of DPs, not of anything in predicative positions, so in (6a) the predicate *Catholic* cannot be evaluated transparently. And this restriction on TE is well-motivated. Predicates do not generally give rise to transparent readings about their extensions; e.g., (7a) is odd in the context of (7), but if it were possible to evaluate *Canadian* transparently, (7a) should have been equivalent to (7b).

- (6) Context: Mary hears that our religious friend John, who we know is catholic, is dating Sue. She concludes Sue must belong to the same denomination as John. We know John is Catholic, but Mary does not.
  - a. Mary thinks that Sue is Catholic. (Sudo 2014)
  - b. Mary thinks that Sue is of the same denomination as John.
- (7) Context: Mary thinks that Pierre, a Canadian, is my brother, and since I am American, she concludes that he is American too
  - a. # Mary thinks that my brother is Canadian.
  - b. Mary thinks of the set of actual Canadians that the person who she thinks is my brother is in that set. (Percus 2000)

The problems are closely related. First, Sudo's example can be construed with predicates whose extension is empty in actuality (cf. Sudo 2014: 451). More generally, both are cases in which a property-denoting element in an intensional context (i.e., *building with 192 floors* in (5a); *Catholic* in (6a)) has a *de re* reading that is distinct from what is derived by simply shifting the evaluation world of that element. Kaufmann and Sudo both derive the correct readings of (5a) and (6a), i.e., the *de dicto* readings of (5b) and (6b), respectively, by property substitution. Sudo, for instance, suggests that any two properties that have the same extension in the worlds closest to actuality in which they are both non-empty, can replace each other in an intensional environment.

### 2.3 Problems #4-5: Revisionist reporting and *de re* presuppositions

Fauconnier (1984) observes that we can truthfully report that *x* believes a proposition *p* even if *x*'s belief state does not entail *p*, as long as *p* is entailed by *x*'s beliefs taken together with some of the reporter's presuppositions.<sup>3</sup> In (8), Borg has no beliefs about Judith, but he would have believed that Judith can learn tennis in two weeks had he known, as Judith's mother does, that Judith is ten. Still, (8a) seems true. The phenomenon has been dubbed *revisionist reporting* by Blumberg & Lederman (2021; henceforth B&L), and extends beyond belief; (9) involves revisionist desire.

<sup>3</sup> Similar cases in Recanati 2012; Baron 2015; Percus 2020, discussed in Blumberg & Lederman 2021.

Consider (8). It is not obvious what exactly Judith's mother is asserting in (8a), and we discuss this further below. Regardless, however, the intuition that (8a) is *true* in the context of (8) suffices to illustrate the problem posed for TE theories.

- (8) Context: Judith is 10. Borg, a tennis teacher, does not know her. Judith's mother knows that Borg thinks anyone over 10 can learn tennis in two weeks, and justifies signing Judith up for two weeks of tennis lessons by saying:
- a. Borg believes Judith can learn to play tennis in two weeks.
- (9) Context: Taylor Swift shouts to a crowded arena: "all the sisters here, clap on the third beat!" My sister is in the crowd, not paying attention. I say to her:
- a. She wants you to clap on the third beat. (adapted from Pryor 2004)

TE theories only let us manipulate the scope of a DP or the evaluation world of its restrictor. The name *Judith* is a non-scope-taking rigid-designator, so TE only derives for (8a) a reading according to which in all of Borg's belief worlds, Judith can learn tennis in two weeks. But Borg does not know Judith. We can represent this in a possible worlds framework by having Judith exist in some but not all of his belief worlds (B&L 2021: 762, fn. 11). Yet if Judith does not exist in some of Borg's belief worlds, then, surely, she cannot learn tennis in all of them. And, as B&L point out, even if we modify the context in (8) as below, (8a) is still judged to be true.

- (8') Context: Borg knows Judith, but not her age. Same as (8) otherwise.
- (8'') Context: Borg knows Judith, but mistakenly thinks she is 9, and therefore cannot learn tennis in two weeks. Same as (8) otherwise.

Yet in the context of (8') Borg's belief state contains both worlds in which Judith can learn tennis in two weeks and worlds in which she cannot, while in (8'') Borg's belief state consists *only* of worlds in which she cannot. TE would thus predict (8a) to be false in the modified contexts, contrary to fact.

The final challenge we consider is as follows: when an attitude's prejacent carries a presupposition, that presupposition need not always hold in the worlds quantified over by the attitude, as long as it does hold in the discourse context.

- (10) John: I am already in bed.  
Mary: My parents think I am *also* in bed. (Heim 1992: 209)
- (11) Context: Sue does not know that it snowed in Boston earlier, but she knows it is not snowing now, and tells this to Beth. Beth and Mira both know that it snowed earlier, and Mira asks Beth whether it still it. Beth tells Mira:
- a. Sue thinks it stopped snowing. (Danny Fox, p.c.)

*Also* in (10) is a presupposition trigger; the utterance *I am also in bed* asserts that the speaker is in bed, and presupposes that someone else is, too. Yet (10) is felicitous

even if Mary's parents do not think anyone besides Mary is in bed. Intuitively, this is because the presupposition is satisfied in the discourse context. Similarly, *stopped snowing* in (11a) presupposes that it snowed before, yet this presupposition is only satisfied in the discourse context, not in Sue's belief state.

We assume (following Karttunen 1974) that reports of the form "x thinks  $\phi$ ," where  $\phi$  presupposes  $p$ , are only defined if  $p$  holds in  $x$ 's belief state. The *de dicto* reading of (11a) is thus undefined, as in the given context the presupposition of *it stopped snowing* does not hold in Sue's belief state by assumption. And given the well-motivated restriction on TE theories that prevents transparent evaluation of predicates (cf. (7)), TE does not derive a *de re* reading of *stopped snowing* in (11a).<sup>4</sup>

Such cases are also originally due to Fauconnier (1984), who notes that they seem closely related to revisionist reports like (8-9). In the revision cases, we seem to treat an attitude holder's belief state as if it contained some of the reporter's knowledge, for the purpose of judging an otherwise *false* attitude report as *true*. In the case of *de re* presuppositions, we again incorporate some of the reporter's knowledge into the belief state of the attitude holder, this time for the purpose of treating an otherwise *undefined* attitude report as *defined*. This is, of course, a very informal description of these problems. We turn next to a potential account.

### 3 *De re* as substitution

The challenges discussed above are often treated in isolation from each other.<sup>5</sup> However, most accounts of problems #1-3 (*double-vision*, empty-extension *third* readings, and *de re* predicates) posit similar mechanisms for replacement of an element  $\alpha$  in an intensional context with another element  $\beta$ , as long as an equivalence condition holds of  $\alpha$  and  $\beta$  in the matrix world. For *double-vision*, substitution of

<sup>4</sup> Even if we were to exempt presupposition-triggering-predicates from the ban on transparent evaluation of predicates (cf. Heim 1992: 209) this would not solve the challenge for TE. Consider the following scenario: In Sue's office, the heat-pump switches on when the temperature decreases below 16° Celsius. Earlier, it was 15°, and the pump was on. Sue was away from the office all day, but has an app that updates her of the office temperature at any given moment. It is now 17°. Sue does not know what temperature triggers the system, so she does not know the system was on earlier, when it was 15°, and forms the belief that it might be on right now. Her office-mates, Mary and Carol, know the pump was on earlier. Sue informs Mary that it is currently 17°. It is infelicitous for Mary to report to Carol "*Sue thinks the heat-pump stopped heating*." However, if it were possible to evaluate the predicate *stopped heating* relative to the matrix world, the report would have been true in the given scenario: Given the set of things that *in actuality* were and are no longer heating, Sue thinks the heat-pump is in that set. This illustrates that only the presupposition of *stopped heating*, not its presupposed and asserted content together, needs to be evaluated relative to the discourse context.

<sup>5</sup> One exception is B&L 2021, which we briefly discuss in section 5.4. Two others are Baron 2015 and Tiskin 2016, which unify problems #1-3 (*double-vision*, empty-extension *third* readings, and *de re* predicates), but either over- or under-generate some revisionist reports.



co-extensional singular terms is assumed, whereas empty-extension *third* readings and *de re* predicates have been used to motivate substitution of predicates.

If we can replace singular terms and predicates, why not generalize to propositions? This is what Percus (2020) suggests for the revisionist belief case in (12). Suppose that a silent element  $R(ephace)$ , can optionally adjoin to the prejacent of an attitude as in (13).  $R$  takes a free variable over propositions as its first argument, and the prejacent of the attitude as its second argument. It then replaces the prejacent with the contextually valued proposition as long as “the truth of the second argument [i.e., the prejacent] is at issue and it is presupposed that the second argument is true as long as the first is” (Percus 2020: 24). If in the context of (12), the variable  $p_3$  in (13) is resolved to the proposition *that Flight AF62 has arrived*, these conditions on replacement are met, and (12a) becomes equivalent to a *de dicto* construal of (12b).

- (12) Context: Mary is on flight AF62. Sue and Carol want to know if she arrived. Sue asks John, who works at the airport but does not know Mary is traveling, whether flight AF62 landed. He says he believes it has. Sue reports to Carol:
- a. John thinks that Mary has arrived.
  - b. John thinks that flight AF62 has arrived.
- (13) John thinks that [ $R p_3$  [Mary has arrived]]

In what follows we pursue this kind of account for the data in section 2, taking Percus 2020 as a point of departure. Since the data involves attitude reports with readings undergenerated by TE, we need to define  $R$  in a way that, if it supplements TE, the resulting theory provides full empirical coverage of attested readings.

We begin by formalizing in (14) Percus’s condition that it be presupposed that  $R$ ’s second argument (the prejacent) is true if its first one (a salient proposition) is.

$$(14) \quad \llbracket R \rrbracket^{g,c} = \lambda p \lambda q \lambda w: \forall w' \in c: p(w') \rightarrow q(w'). p(w) \quad (\text{to be revised})$$

Given a context parameter  $c$ , i.e., the set of all worlds compatible with what discourse participants take for granted (Stalnaker 1978), (14) licenses replacement of a prejacent  $q$  with a contextually salient proposition  $p$  only if every  $p$ -world in  $c$  is a  $q$ -world. In (12), it is presupposed that Mary is on flight AF62 and therefore any context world in which flight AF62 arrived is a world in which Mary did too.  $R$  thus licenses replacement of the prejacent in (12a) with the one in (12b), as desired.

Of course, for any context  $c$  and propositions  $p, q$ , if  $q$  is true in  $c$ , the presupposition in (14) holds regardless of our choice of  $p$ . Thus, (14) predicts that when a prejacent is presupposed, any salient proposition could replace it. Percus’s condition that replacement apply to *at-issue* prejacent rids us of this prediction: Following Lewis (1988); Roberts (2012) (*a.o.*), we assume being *at-issue* means constituting a relevant answer to the salient question under discussion (QUD), which partitions the context set into non-empty subsets, and that a proposition is a relevant answer to the

QUD if it is a union of some but not all of these subsets. An at-issue prejacent is true in some but not all worlds in *c*, and an at-issue-ness condition on replacement thus precludes replacement of prejacentes whose truth value is constant throughout *c*.

However, this condition is too restrictive. First, it fails even for revisionist belief (Danny Fox, p.c.). The prejacent in (15a) is presupposed and in (16a) it is presumed false. So replacement of both non-at-issue prejacentes with the proposition *that Flight AF62 has arrived* should be licensed. Second, in our broader theoretical pursuit, the condition precludes us from using *R* to account for the challenges to TE above. Quine's context in (4) licenses replacement of the prejacent in (17a) with the proposition in (17b), regardless of whether we presuppose Orcutt is a spy. For Kaufmann's empty-extension case (5), the prejacent in (18a) can be replaced with the proposition in (18b), despite the fact that the prejacent is a contextual contradiction.

- (15) Context: Mary is on flight AF62. Sue and Carol come to pick her up. They plan to meet airport-employee John (who is ignorant of Mary's travels) as the flight arrives, at its arrival gate. AF62 arrives. John is late. Sue to Carol:
  - a. John knows Mary landed. (He is just always late.)
- (16) Context: Mary is on AF62. John does not know this. Mary texts Sue and Carol that AF62 is delayed due to turbulence. John's workday at the airport offices ends only after AF62 lands. Unaware of the delay, he leaves work on AF62's scheduled arrival time. He texts Sue that he left. Sue to Carol:
  - a. Despite Mary still being in the air, John thinks that she landed (which only goes to show you how disorganized they are at the airport's main office).
- (17) a. Ralph believes that Orcutt is a spy.
  - b. that the man he saw at the beach is a spy.
- (18) a. Mary wants PRO<sub>Mary</sub> to buy a building with 192 floors.
  - b. PRO<sub>Mary</sub> to buy a building that is one floor higher than BD.

But without the at-issue-ness constraint, the formulation of *R* in (14) fails in another instructive way. When an attitude's prejacent is false in context, the presupposition of *R* in (14) can only hold vacuously, if the replacing proposition is also a contextual contradiction. So (14) licenses replacement of a contextually false prejacent with *any* salient contextual contradiction; e.g., in the context of (16) Mary is on the delayed flight AF62, so (19a) could in principle be equivalent to (19b) (on its *de dicto* reading), as both reports involve contextually false prejacentes.

- (19) a. John thinks that Mary landed.
  - b. John thinks that Mary is not on flight AF62.

The problem persists if we replace the material implication in (14) with counterfactual entailment as in (20). In the context of (16), (19a) seems to truthfully convey



that John thinks flight AF62 landed. Discourse participants in (16) presuppose (a) *that Mary is on AF62*; and (b) *that Mary did not land*. Among the closest worlds where AF62 landed, then, some are worlds in which Mary landed, i.e., those that preserve the truth of (a). But some preserve the truth of (b), rendering the counterfactual presupposition in (20) false.

$$(20) \quad \llbracket R \rrbracket^{g,c} = \lambda p \lambda q \lambda w: \forall w' \in c: [p \Box \rightarrow q](w'). p(w) \quad (\text{to be revised})$$

(where for any  $w, p, q$ :  $[p \Box \rightarrow q](w)$  iff  $w$ 's closest  $p$ -worlds are  $q$ -worlds)

The problem with (14) and (20) is that both evaluate entailment from the replacing proposition  $p$  to prejacent  $q$  either in  $c$ , or in a set of worlds derived from  $c$  via a similarity relation. This is misguided, because as we show, whether or not  $p$  or  $q$  are true in  $c$  does not impact whether replacement of  $q$  with  $p$  goes through. We explore next an alternative formulation of the conditions on replacement.

#### 4 Constraints on substitution

Assuming an analysis of attitude predicates as universal quantifiers over possible worlds (Hintikka 1962), as we have been doing implicitly so far, we can characterize our challenges to TE as follows: In all, an attitude report is judged true despite the fact that the attitude's prejacent  $q$  does not hold throughout the attitude's domain of quantification, as long as there is a proposition  $p$  that does hold in that domain, and a proposition  $r$  that holds in the context of utterance, such that  $r \cap p \subseteq q$ .

What we are after is a mechanism that given this state of affairs, replaces  $q$  with  $p$ , and what we are missing is a definition of the set of worlds in which entailment from  $p$  to  $q$  must hold. We show above that this set should not be derived from the context set via similarity, yet we still need some information true in the context set to hold throughout that set of worlds. The solution we will pursue is in (21). The presupposition of  $R$  in (21) existentially quantifies over contextual tautologies (supersets of the context), and licenses the replacement of a prejacent  $q$  with a contextually salient proposition  $p$  as long as entailment from  $p$  to  $q$  holds in sets of worlds that witness this existential quantification.

$$(21) \quad \llbracket R \rrbracket^{g,c} = \lambda p \lambda q \lambda w: \exists r \supseteq c [r \not\subseteq q \wedge \forall w' \in r: p(w') \rightarrow q(w')]. p(w)$$

(to be slightly revised)

How does (21) account for the challenges to TE in section 2? In Quine's *double-vision* context, it is presupposed that the man Ralph saw at the beach is Orcutt. This, together with the proposition that the man Ralph saw at the beach is a spy, entails that Orcutt is a spy. Therefore, replacement of the prejacent in (17a) with the proposition expressed in (17b) is licensed. In Schwager's context, it is presupposed that BD has 191 floors. This, together with the proposition that Mary buys a building one floor

higher than BD, entails that Mary buys a building with 192 floors. Replacement of the prejacent in (18a) with the proposition expressed in (18b) is thus licensed as well. Similarly, in Sudo's example of *de re* predicates, it is presupposed that John is Catholic. This, together with the proposition that Sue is of the same denomination as John, entails that Sue is Catholic. Replacement of the prejacent in (6a) with the proposition expressed by the prejacent in (6b) is thus also licensed.

As defined in (21), *R* also licenses replacement of any presuppositional prejacent with its presuppositionless variant, as long as the presupposition holds in the context of utterance. This accounts for the cases we term *de re* presuppositions. In (11), for example, Sue's beliefs do not determine whether it snowed earlier or not, and yet we can still felicitously and truthfully utter (11a), ascribing to Sue belief in the proposition *that it stopped snowing*. Crucially, *that it snowed earlier* holds in the context, and this together with the proposition *that it is not snowing now* entails the prejacent of (11a). Thus, that prejacent can be replaced with the latter proposition.

Finally, (21) is designed to account for cases of revisionist attitude reports like Percus's example in (12). In that context it is presupposed that Mary is on flight AF62, and in all worlds that make this presupposition true, if flight AF62 arrived, Mary did as well. We can therefore use the report in (12a) to express the (*de dicto*) reading of (12b). Our account also accounts for Fauconnier's original case of revisionist reporting, i.e., the tennis case in (8). However, in that case, there are several propositions that together with the contextual tautology that Judith is 10, entail the proposition that Judith can learn to play tennis in two weeks. For instance, both propositions in (22) meet the condition on replacement formalized in (21).

- (22) a.  $\{w: \text{every 10-year-old in } w \text{ can learn tennis in two weeks in } w\}$   
       b.  $\{w: \text{Judith is not 10 in } w \text{ or Judith can learn tennis in two weeks in } w\}$
- (23) a. Borg believes every 10-year-old can learn to play tennis in two weeks.  
       b. Borg believes that if Judith is 10, she can learn to play tennis in two weeks.

This illustrates that our conditions on replacement under-determine which belief report a sentence like (8a) asserts as true; is it the (*de dicto*) report in (23a), (23b) or another one altogether? Can we rely on our requirement that the replacing proposition be *contextually salient* to answer this question? We further discuss these questions when we review some challenges to a substitution account below.<sup>6</sup>

<sup>6</sup> A precursor to the approach explored here is van Fraassen (1979), who claims that under-determination of the belief ascribed by belief reports is not a bug, but a desired feature of an account of these reports:

“*x* believes that *A*” is true if and only if a certain proposition is one of *x*'s beliefs – though that is not generally the proposition which is the content of *A* (in the given context). . . Perhaps also the identity of that proposition is not totally determined.  
(van Fraassen 1979: 370)

Before that, however, (21) requires further modification. First, (21) licenses replacement of any proposition  $q$  with a logically stronger proposition  $p$ . If  $p \subseteq q$ , the presupposition in (21) holds for any context. Yet while (24a) is true whenever (24b) is, it does not have a reading on which the two are equivalent. Its negation, for instance, is not true when Mary thinks some but not all students arrived, whereas the negation of (24b) is. We can fix this by banning replacement of  $q$  with  $p$  if  $p \subseteq q$ .

- (24) a. Mary thinks that some student arrived.  
b. Mary thinks that every student arrived.

Second, the examples in section 2 can all be further embedded under another attitude, giving rise to *intermediate readings* that TE cannot accommodate. For conciseness, we illustrate this only for a subpart of the data in examples (25-27).

- (25) Ralph saw Bill at the beach, but Mary believes it was Orcutt whom he saw there and thinks that he believes Orcutt is a spy. (embedded *double-vision*)<sup>7</sup>  
(26) Judith is 9, but her gym teacher believes she is 10 and thinks that Borg believes she can learn tennis in two weeks. (embedded *revisionist reporting*)  
(27) No-one at the sleepover is asleep, but Mary thinks her friend is, and believes her parents think she is also asleep. (embedded *de re* presupposition)

In the underlined parts of (25-27), it is asserted that  $x$  ascribes to  $y$  belief in a proposition  $q$ , when in fact  $x$  does not believe that  $y$ 's belief state entails  $q$ . Rather,  $x$  believes that  $y$ 's belief state entails a proposition  $p$ , which together with something that  $x$  believes (falsely, given the contexts above), entails  $q$ . For  $R$  to account for this, the proposition existentially-quantified over in its presupposition (in which we evaluate entailment between proposition  $p$  and the attitude's prejacent  $q$ ) need not be true in the context of utterance, as long as it is true in the embedding context.

To account for (25-27),  $R$  needs access to the worlds quantified over by an embedding attitude. We implement that by adopting a particular TE theory, termed *the standard approach* by von Fintel & Heim (2011), which posits syntactic world-variables bound by  $\lambda$ -abstractors located under every intensional operator and above every matrix sentence (Percus 2000). We then add a world argument to  $R$  as in (28). Given the syntax in (29) for an embedded attitude report with  $R$  on the lowest clause,

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According to van Fraassen, a report that  $x$  believes  $A$  in  $w$  is only defined given a "hidden" propositional parameter, termed the *contextual auxiliary*, and is true only if there is a belief of  $x$  in  $w$  that is equivalent to  $A$  given the contextual auxiliary. Note that the difference between the replacement mechanism in (21) and van Fraassen's account of belief is that while we existentially quantify over possible contextual auxiliaries and assume the replacing proposition is contextually salient, van Fraassen quantifies over possible replacing propositions and assumes the contextual auxiliary is contextually salient. We shall see in section 5 that there may be a reason to doubt both approaches.

<sup>7</sup> These cases are discussed in Charlow & Sharvit 2014.

$R$  takes a world  $w$ , a free variable  $p$ , and the prejacent  $q$  of the embedded attitude, and replaces  $q$  with  $p$  as long as two conditions hold: (a)  $p$  does not logically entail  $q$ ; and (b) there is a proposition true in  $w$  that together with  $p$  logically entails  $q$ .

$$(28) \quad \llbracket R \rrbracket^{g,c} = \lambda w \lambda p \lambda q \lambda w' : (p \not\subseteq q) \wedge \exists r \not\subseteq q [r(w) \wedge p \cap r \subseteq q]. p(w')$$

$$(29) \quad [\lambda_i \dots [\text{ATTITUDE } \lambda_j \dots [\text{ATTITUDE}' \lambda_k \llbracket R(w_i/j/*k)(p_7) \rrbracket [\text{PREJACENT}]]]]]$$

We posit a binding condition on  $R$ 's world argument  $w$ , according to which it cannot be bound locally by the  $\lambda$ -abtractor immediately dominating it (this is indicated by  $*k$  as an index on  $w$  in (29)).<sup>8</sup> However,  $w$  can be bound by either the matrix  $\lambda$ -abtractor ( $\lambda_j$ ) or by the  $\lambda$ -abtractor at the intermediate embedding level ( $\lambda_i$ ).

The latter option derives (25-27). The underlined part of (25), repeated in (30a), has the LF in (30b). If  $w$  is bound by  $\lambda_j$  in (30b),  $R$  replaces the prejacent with a proposition that together with something that *Mary* thinks, entails that prejacent. This is the case in (25), where *Mary* (mistakenly) thinks *that the man Ralph saw at the beach is Ortcutt*, and (30a) can ascribe to her the belief *that Ralph believes the man at the beach is a spy*. (30a) is also true if the man *Ralph* actually saw at the beach is Ortcutt, even if *Mary* does not think so, as long as *Mary* ascribes to *Ralph* the belief that the man at the beach is a spy. Binding  $w$  to  $\lambda_i$  makes this reading true.

- (30) a. *Mary* thinks that *Ralph* believes that Ortcutt is a spy.  
 b.  $[\lambda_i \text{ Mary thinks } \lambda_j [\text{Ralph believes } \lambda k \llbracket R(w_i/j)(p_7) \rrbracket [\text{Ortcutt is a spy}]]]$ .

Our entries for  $R$  in (28) and (21) are not equivalent even for unembedded cases, where  $R$ 's world argument only has one possible binder. Given (21), replacement is only licensed in, say (12), if discourse participants take for granted that *Mary* is on flight AF62. Given (28), only the speaker needs to take this for granted. Yet our requirement that the replacing proposition be *contextually salient* still places a burden on all discourse participants: They all must know what the replacing proposition is (in (12), it is the proposition *that flight AF62 arrived*), and presuppose that the speaker's beliefs together with that proposition entail the attitude's prejacent. We explore next some challenges to a substitution approach, starting with the observation that sometimes replacement goes through even when this burden is not met.

<sup>8</sup> Note that if attitudes like *believe*, *think*, and more controversially *want* are assumed to be upward monotone (see Crnić 2011 for an overview of the debate on the monotonicity of *want*), binding  $R$ 's world argument to the  $\lambda$ -abtractor immediately dominating it will result in replacement that is redundant in the following sense: Given an attitude report  $\phi$  corresponding to (at least) two LFs,  $\text{LF}_{\phi_1}$  and  $\text{LF}_{\phi_2}$ , such that  $\text{LF}_{\phi_1}$  derives the *de dicto* reading of  $\phi$  and  $\text{LF}_{\phi_2}$  has a replacement operator whose world argument is bound by the lowest  $\lambda$ -abtractor, whenever the truth-conditions derived from  $\text{LF}_{\phi_2}$  are true, those derived from  $\text{LF}_{\phi_1}$  are also true. If we had a general constraint, ruling out LFs with  $R$  when a corresponding *R-less* LF is also true, that constraint would rid us of the need to posit a binding condition, at least when we are dealing with upward monotonic attitude predicates. Further work is required to examine whether this way of blocking local binding of  $R$ 's world variable makes good predictions. For our present discussion, positing a binding condition will do.

## 5 Further observations and challenges

### 5.1 Contextual salience

The proposition that *R* replaces the prejacent of an attitude with, i.e., *the replacing proposition*, is required to be salient in the discourse context. This, arguably, is the effect of introducing it with a free variable, on the standard assumption that uttering a sentence with a LF  $\phi$  in a context *c* is only appropriate if *c* determines a variable assignment defined for every index free in  $\phi$  (Heim & Kratzer 1998: 243).

This approach is appealing, as it straightforwardly accounts for a dialogue like (31), where B's baffled response can be explained by the fact that the replacing proposition that A intends to ascribe belief in to Borg is not contextually salient.

- (31) Context: Borg, a tennis instructor, thinks every 10-year-old can learn tennis in two weeks. A knows this, and also knows Judith is 10. B knows Judith but not her age, and knows Borg is a tennis expert but not his particular opinions.

A: Borg believes Judith can learn to play tennis in two weeks.

B: What are you talking about?! He doesn't even know Judith.

However, this raises several problems. First, even when discourse participants know all the relevant facts, our conditions on replacement still under-determine what the replacing proposition might be. In Fauconnier's original revision case (8), for instance, we suggest at least two plausible replacements, i.e., those in (22), and there is no genuine sense in which one is more or less contextually salient than the other.

Second, B's bafflement in (31) is in tension with her acquiescence in (32), where even if A has in mind a particular replacement, B cannot know what it is. Still, B seems willing to grant that someone who must be a tennis expert has a belief which, together with something A knows about Judith, entails the prejacent of A's report.<sup>9</sup>

- (32) Context: A is reading a magazine interview with Borg, who is quoted saying that every 10-year-old can learn tennis in two weeks. A knows Judith is 10. B does not, and also has no idea who Borg is, but can see the magazine A is reading has the word 'Tennis' on its cover. A stops reading and turns to B.

A: This guy here believes Judith can learn to play tennis in two weeks.

B: Oh, maybe you should sign her up for lessons and see if he's right.

Note that in all the examples we try to account for with replacement above, the replacing proposition is contextually salient simply because we stipulated as much. For instance, in Quine's example (4), we stated it as fact that Ralph believes *de dicto*

<sup>9</sup> The observations in (31-32) are due to personal communication with Kai von Fintel and Danny Fox, whose comments greatly influenced the discussion in this section.

that the man at the beach is a spy, while in Schwager's empty-extension case (5), we describe Mary as thinking to herself 'I want to buy a building one floor higher than BD!' Yet in such cases, too, the identity of the replacing proposition need not be common ground. This is illustrated by (33) from Zimmerman 1991.

(33) The Godfather believes that our infiltrated agent is reliable.

The speaker in (33) need not assume that her addressees have in mind a particular proposition in which she is ascribing to the Godfather belief *de dicto* (e.g., *that the Godfather's new chauffeur is reliable*). She only has to assume that they can accommodate the existence of a proposition that meets our conditions on replacement.

We can respond to this challenge either by allowing existential closure of *R*'s propositional variable above the attitude predicate, or by keeping it a free variable while allowing accommodation of the existence of a suitable referent.<sup>10</sup> The former approach must explain B's bafflement in (31); the latter, its lack thereof in (32). More generally, we must either identify which environments presuppose discourse participants have in mind a particular witness to existential quantification, or distinguish environments that allow accommodating the existence of a suitable referent for the propositional variable from those that do not.<sup>11</sup>

A final example that might bear on this issue is (34). Suppose tennis teachers fall into three groups; those who think being a certain age guarantees two-week tennis-learning, those for whom height matters, and those who posit a weight cutoff. If Judith makes all three cutoffs, (34) seems true, even if uttered as part of a discourse context in which only the speaker knows Judith's age, height and weight.<sup>12</sup>

(34) Every tennis instructor believes Judith can learn to play tennis in two weeks.

Existentially closing the replacing proposition above the attitude and below the universal quantifier accounts for this, as it allows the replacing proposition to vary with tennis instructors. A free variable approach requires a more creative story; perhaps we should allow the addressees of (34) to accommodate the existence of a *disjunctive* proposition which all tennis instructors believe, and which together with the speaker's knowledge entails the prejacent of (34).

## 5.2 At-issue-ness

We reject above Percus's (2020) proposed at-issue-ness condition on *R* (i.e., the condition that *R* only apply to at-issue prejacent) as too restrictive, since prejacent

<sup>10</sup> Depending on one's approach, this might mean finding a way to exempt the free variable from the strict appropriateness condition on LFs with free variables, which requires the immediate context to determine their referents. Some relevant discussion is in Beaver & von Stechow 2013, 2015; King 2018.

<sup>11</sup> Sæbø 2015: §4.2 is a useful discussion of a similar issue concerning singular term substitution.

<sup>12</sup> Tiskin (2020) examines a similar example, citing the need for further empirical work.



that are true or false in context can also be replaced. However, we illustrate next that at-issue-ness does seem to constrain replacement, albeit in a more restricted way.

Replacement as defined in (28) predicts it to be possible in certain contexts to utter “ $x$  believes  $\phi$ ” even when  $x$  believes (*de dicto*) that not- $\phi$ . This is by design. Recall the context in (8’), where Borg, who believes only 10-year-olds can learn tennis in two weeks, knows 10-year-old Judith but mistakenly thinks she is 9. Despite Borg believing (*de dicto*) that Judith cannot learn tennis in two weeks, we still seem to be able to felicitously report that he believes she can, in order to justify signing Judith up for two weeks of tennis classes. Replacement accounts for that intuition.

On the other hand, for instances of *de re* predicates this seems to overgenerate. Cable (2011) observes that if  $x$  believes (*de dicto*) that not- $\phi$ , then “ $x$  believes  $\phi$ ” does not have a reading on which a predicate in  $\phi$  has been replaced. Take (6), where we can report *Mary believes Sue is Catholic* (6a) by virtue of Mary believing that Sue and John are of the same denomination, and the reporter believing that John is Catholic. If Mary believes Sue and John are Protestant, that report suddenly seems infelicitous (Tiskin 2016). Yet in this modified context, the reporter still knows John is Catholic and that Mary thinks John and Sue are of the same denomination, so  $R$  as in (28) should still generate a reading of (6a) equivalent to (6b), read *de dicto*.

We argue that at-issue-ness is involved in differentiating the case in (6) from the one in (8’). Suppose that Mary, knowing John well, believes he would never date outside his religion. She thinks John and his date Sue are both Protestant. I know that Mary is often confused about religious affiliation, and that John is in fact Catholic. For some reason, you are sorting people according to their religion and you ask me what is Sue’s denomination. I am unsure, but I know that Mary is a reliable source on John’s dating life, and a not-so-reliable source about people’s religions. In this context, where Sue’s religion is at-issue, it seems acceptable for me to utter (6a).

If our judgement is correct, then at least in belief reports,  $R$  is subject to an at-issue-ness constraint: If  $x$  believes not- $\phi$  *de dicto*, replacement of  $\phi$  in “ $x$  believes  $\phi$ ” is licensed only if  $\phi$  is at-issue. Given that we assume a syntax in which  $R$  does not “see” the attitude above it (29), this condition cannot be formulated in the system above (it can be posited if we modify  $R$  so that it takes the attitude verb itself as an argument, but we avoid doing so here due to space limitations). This condition also does not seem to extend to reports with other attitude predicates, and so further work is required to determine its scope and status.

### 5.3 Overgeneration

Our replacement mechanism is powerful enough to derive the data undergenerated by TE. However, it is too powerful. We review next cases of overgeneration, sketching potential solutions when possible, but leaving most issues for future research.

**Weakening via replacement** Let  $X$  be a set of scalar items ordered by entailment  $\langle X_1, X_2, X_3, \dots, X_n \rangle$ ,  $\phi_{X_i}$  be a sentence containing some  $X_i \in X$ , and  $\phi_{X_j}$  be the sentence derived by replacing  $X_i$  in  $\phi_{X_i}$  with some  $X_j \in X$ , such that  $j < i$  (where  $\phi$  is an entailment-preserving environment). Suppose we know that an individual  $x$  (*de dicto*) believes  $\phi_{X_j}$ . Suppose we also know that if  $\llbracket \phi_{X_j} \rrbracket$  (the weaker proposition) is true,  $\llbracket \phi_{X_i} \rrbracket$  (the stronger one) is true as well. In this context, we still cannot felicitously utter “ $x$  thinks  $\phi_{X_i}$ ” despite the fact that the conditions for replacing  $\llbracket \phi_{X_i} \rrbracket$  with  $\llbracket \phi_{X_j} \rrbracket$  are met. Some examples are in (35–36).

- (35) Context: Mary thinks two students came to the seminar. We know that another student, who Mary thinks did not come to the seminar, also came.
- a. # Mary thinks that three students came to the seminar.
  - b. that two students came to the seminar.
- (36) Context: Mary thinks a bag contains at least 3kg of cloths. We know it carries at least 5kg of books. Anything below 5kg is light; anything above it is heavy.
- a. # Mary thinks that the bag is heavy.
  - b. # Mary thinks that the bag weighs at least 8kg.

In (35–36), conditions on  $R$  license replacement of the prejacent with a strictly weaker proposition; namely, a proposition expressed by a sentence that is derived by replacing a scalar item in the prejacent with a weaker item on its scale. The weaker proposition, together with contextual knowledge, logically entails the stronger one. E.g., in (35) what Mary (*de dicto*) believes is the proposition expressed by (35b), which together the reporter’s knowledge entails the prejacent of (35a).

Banning replacement of a prejacent by a proposition that it logically entails does not solve the general problem. If  $x$  (*de dicto*) believes  $\llbracket \phi_{X_j} \rrbracket$  in virtue of her believing something stronger than  $\llbracket \phi_{X_j} \rrbracket$ , call it  $\llbracket \phi_{X_j} \rrbracket^+$ , and if  $\llbracket \phi_{X_j} \rrbracket^+$  can be made contextually salient, then we should be able to replace  $\llbracket \phi_{X_i} \rrbracket$  with  $\llbracket \phi_{X_j} \rrbracket^+$  whenever we know that if  $\llbracket \phi_{X_j} \rrbracket$  is true  $\llbracket \phi_{X_i} \rrbracket$  is true and  $\llbracket \phi_{X_i} \rrbracket$  does not entail  $\llbracket \phi_{X_j} \rrbracket^+$ , contrary to fact. This can be shown by modifying the context in (35): Mary thinks two *tall* students arrived, we know that a *short* one did. The proposition *that two tall students arrived*, together with contextual knowledge, entails the prejacent of (35a) and is not entailed by it, and yet replacement between the two still should not go through.

The general point is that we should not be able to achieve weakening via replacement, in the following sense:  $R$  should not be able to replace a prejacent containing a scalar item with a proposition  $p$ , if  $p$  entails the proposition derived by switching out the scalar item in the prejacent with a weaker item on the same scale. Just describing this point requires that we make reference to the structure of the prejacent. But since  $R$  only has access to propositions, not to structures that express them, the proposal outlined above surely requires additional machinery to account for this point.

**Redundant revision** B&L (2021) point out that in the tennis context in (8), where we can truthfully utter (37), the report in (38) is infelicitous. Yet conditions for replacement are met by both (37) and (38), so (38) should have the same reading that makes (37) felicitous and true in the tennis context. To see this, notice that the proposition expressed in (39), together with our knowledge that Judith is 10, entails the prejacent in both (37) and (38), so both prejacentes can be replaced with (39).

- (37) Borg believes that Judith can learn to play tennis in two weeks.  
 (38) #Borg believes that Judith is 10 and can learn to play tennis in two weeks.  
 (39) that every 10-year-old can learn to play tennis in two weeks.

We can account for the infelicity of (38) by stipulating that *R* is barred from scoping above conjunction; i.e., if it is to apply at all, *R* must apply separately to each conjunct in an attitude's prejacent. The second conjunct in (38) can be replaced with the proposition in (39). But what about the first conjunct? Since Borg does not believe *de dicto* that Judith is 10, that conjunct, too, needs to be replaced. But nothing in the tennis context suggests any plausible replacing propositions that meet *R*'s conditions and would make (38) true, so the report is infelicitous in that context.

**Too many *de re* presuppositions** *R* can replace any presuppositional prejacent with its presuppositionless variant, as long as the prejacent's presupposition holds in the discourse context; this allows us to account for *de re* presuppositions. But this is also known to overgenerate (cf. Zeevat 1992; Geurts 1999; Schlenker 2011; Blumberg 2023). If *R* can replace the prejacent of belief in (40) with the proposition *that it is not raining*, which together with the contextual knowledge that it rained earlier entails the prejacent, (40) should have been felicitous – contrary to fact. A viable substitution account requires a condition that distinguishes between environments that allow transparent satisfaction of presuppositions from those that do not, and blocks replacement in the latter case, but we cannot offer such a condition here.

- (40) It was raining the whole morning, but John is convinced it wasn't.  
 #He believes it stopped raining. (adapted from Schlenker 2011: 385)

## 5.4 A theoretical consideration

The account of revisionist reports in B&L 2021 also extends to the challenges to discussed TE above (and as far as we can tell, suffers from similar overgeneration problems). Due to space limitations, we do not engage in a careful comparison of the two proposals, but only flag an important difference: B&L suggest that belief reports are always parameterized to a question *Q*, and that  $\llbracket x \text{ believes } p \text{ in } w \rrbracket^Q$  is true just in case the revision of *x*'s belief state in *w* with the answer to *Q* in *w* entails

$p$ . Revision of a belief state  $\mathcal{B}$  with a proposition  $p$  is either  $p \cap \mathcal{B}$ , if non-empty, or the set of  $p$ -worlds most similar to  $\mathcal{B}$ . In the tennis context (8), (37) is true because Borg's belief state, revised by the answer to the question *Is Judith 10?*, entails the prejacent of (37). Crucially, on B&L's approach, to truthfully ascribe to  $x$  a belief that  $p$ , the set of worlds required to entail  $p$  is not  $x$ 's belief state, but some other set derived from  $x$ 's belief state via revision. On our proposal, on the other hand, the predicate *believe* always denotes Hintikka belief. In fact, even a revisionist belief report is argued to make a claim about the attitude holder's belief state, just not the one made by the corresponding *de dicto* construal of the belief report.

Whether one account is superior to the other, then, depends first and foremost on whether it is justified to treat revisionist belief reports as claims about the attitude holder's belief state. In other words, does (37) ascribe some belief (*de dicto*) to Borg, or is it a claim about what is entailed by a belief of Borg together with the reporter's knowledge? This, too, merits a more serious discussion than space limitations allow.

## 6 Conclusion

We use propositional substitution to derive a body of data that TE fails to generate, and review some merits and weaknesses of this approach. Our discussion serves to highlight several observations: (i) Felicitous revisionist reports may have non-at-issue prejacent (15-16). (ii) Revisionist reports and *de re* presuppositions give rise to intermediate readings when further embedded (26-27). (iii) The proposition towards which an attitude is ascribed in a revisionist report is under-determined and is sometimes contextually accommodated (32). (iv) In revisionist reports with quantified subjects, the proposition towards which an attitude is ascribed can vary with those being quantified over (34). (v) At-issue-ness of an attitude's prejacent plays a role in determining whether substitution applies, albeit in a more limited way than previously considered (as far as we know, (i-ii) and (v) are novel observations).

We leave many empirical and theoretical questions unaddressed. For instance, empirically, are there attitude predicates whose prejacent resist replacement (i.e., that do not give rise to readings of the kinds discussed above)? Nothing in the way  $R$  is defined here precludes it from adjoining to the prejacent of any attitude, but it is to be determined whether this fits the empirical landscape. Theoretically, can our proposal extend to other challenges to TE not discussed here? E.g., bound *de re* pronouns (Charlow & Sharvit 2014) or specific-opaque readings (Szabó 2010).<sup>13</sup> Finally, if substitution is indeed on the right track as an account of non-transparent *de re*, a broader conceptual question must be addressed; namely, why should natural language make available a substitution mechanism to begin with?

<sup>13</sup> In Benbaji (2021) we suggest that at least some instances of specific-opaque readings should be derived via the same mechanism that derives revisionist attitudes.

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