

That Solution to Prior's Puzzle¹

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Abstract

Prior's puzzle is a puzzle about the substitution of certain putatively synonymous or coreferential expressions in sentences containing attitudinal verbs such as *believe* and *hope*. Prior's puzzle is important, because a satisfactory solution to it should constitute a crucial part of an adequate semantic theory for both sentence-embedding expressions *the statement that P* and attitudinal verbs. I argue that two recent solutions to this puzzle are unsatisfactory. They either focus on the meaning of attitudinal verbs or content nouns. I propose a solution relying on a recent analysis of *that*-clauses in linguistics. Our solution is superior, as it not only avoids the problems faced by previous solutions, but it also brings developments in linguistics in line to solve an old puzzle in philosophy.

1. Introduction

Prior's puzzle is a puzzle about how the substitution of two *prima facie* synonymous expressions in a sentence can change its meaning (Prior, 1963). Assume that the meaning of a sentence is determined by the meanings or references of its subexpressions. Substituting one of its subexpressions for a synonymous or co-referential subexpression should preserve sentence meaning—at least in extensional contexts. For instance, the expression *the proposition that Fido barks* seems to refer to the proposition that Fido barks.² *Prima facie*, the complement phrase *that Fido barks* also seems to refer to the proposition that Fido barks. There are two reasons for this. First, *that*-clauses can appear in subject position and we can predicate truth and falsity of them, just as we can propositions. For instance, we can say:

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² I take propositions to be meanings of well-formed sentences, whether these are sets of situations, possible worlds, or other entities that can be indices of evaluation for a given sentence. I take sentences to be strings of symbols arranged according to the rules of a given language. Throughout the paper I use italics to mention linguistic expressions. I use expressions such as *means P* and *refers to P* interchangeably, as *refers to* sounds more natural when paired with entities, whereas *means P* sounds better when paired with sentences. I take the meaning of an expression to be what it refers to. The meaning/reference of a sentence is the proposition expressed by the sentence, whereas the meaning/reference of an entity description, e.g., *the proposition that P*, is the entity described, e.g., the proposition that P, unless otherwise stated.

- (1) That Fido barks is true.

Second, *that*-clauses complement propositional attitudes, as in:

- (2) a. Sally believes that Fido barks.
b. Sally believes the proposition that Fido barks.

Both (2-a) and (2-b) are naturally understood as expressing that the belief relation holds between Sally and the proposition expressed by *Fido barks*.³ Given this, the synonymy of (2-a) and (2-b) is predicted by a sacrosanct principle in philosophy of language:

Substitutivity Salva Veritate (SSV): Coreferential expressions can be substituted for one another while preserving truth value in extensional contexts.

Yet SSV seems violated by (3-a) and (3-b):

- (3) a. Sally fears that Fido barks.
b. Sally fears the proposition that Fido barks.⁴

(3-a) means that Sally fears her dog Fido's barking or the possibility of his barking. However, (3-b) means that Sally fears some proposition. As Sally may be merely concerned with her dog's barking behavior as opposed to interested in a proposition, (3-a) and (3-b) express different propositions, even though the only subexpressions that differ in (3-a) and (3-b) purportedly refer to the same entity. This change in meaning is Prior's puzzle.

³ Such considerations became even more forceful with analyses of attitudes as formal relations (e.g. Fodor 1987).

⁴ Substituting the *that*-clause in (3-a) with the proposition description in (3-b) does not affect grammaticality; but this is not always the case:

- (i) a. Sally hopes that Fido barks.
b. *Sally hopes the proposition that Fido barks.

This is *Rundle's puzzle* (Rundle, 1967). Nebel (2019: §2) shows it can be solved by certain assumptions about how to translate attitudinal verbs when they are complemented with content nouns. With Nebel's solution, Rundle's puzzle reduces to Prior's puzzle.

There are only two parameters that a solution to Prior’s puzzle can tweak. Taking attitudinal verbs to express two-place relations between possessors and content of these attitudes, one can either say something about the meaning of attitudinal verbs such as *believe*, *fear*, *hope* or about the meaning of clauses complementing these verbs such as *that P* or *the proposition that P*.⁵

In this paper, I criticize two attempts to solve Prior’s puzzle—one by Jeffrey King (2002) and one by Jacob Nebel (2019)—and offer a solution that avoids these criticisms.⁶ King and Nebel tweak alternative parameters. King attempts to resolve Prior’s puzzle by arguing for polysemy in attitudinal verbs. Nebel attempts to resolve Prior’s puzzle by denying that *contentful entity* descriptions refer to entities they apparently do.⁷ Both solutions are unsatisfactory. King’s solution fails to accommodate Nebel’s data, whilst Nebel’s solution fails to accommodate a large class of causal predicates such as *hurt*, *astonish*, *surprise* (Moltmann, 2003). I offer an alternative solution that exploits an account of *that*-clauses from the linguistics literature (Kratzer, 2006; Moulton, 2009). This resolves Prior’s puzzle without falling prey to the problems confronting King and Nebel.

2. King’s Solution

King (2002) proposes a solution to Prior’s puzzle that targets the meaning of attitudinal verbs. King argues that verbs that give rise to Prior’s puzzle such as *fear* do not express a single relation that relates an individual both to the object of *that*-clauses and to that of contentful entity descriptions. Instead, they express different relations depending on the complement taken. King’s solution thus postulates systematic polysemy for verbs that give rise to Prior’s puzzle.

With respect to (2), King argues that *believe* is not polysemous, since its instances in (2-a) and (2-b) generate propositions that are either both true or false in the same circumstances. Both express that Sally stands in the belief relation to the proposition that Fido barks. On the other hand, according to King, instances of *fear* in (3) generate different propositions for (3-a) and (3-b). (3-a) is true iff Sally stands in the fear relation to her dog barking, whereas (3-b) is true iff Sally stands in the fear

⁵ Some conclude from the puzzle that the analysis of attitude verbs that proposes that attitude verbs express relations between individuals and propositions is wrong (Bach, 1997; McKinsey, 1999). I will bracket these views in my discussion.

⁶ Prior’s puzzle is old (Prior, 1963) and naturally these two views are not the only solutions offered. For instance, Parsons (1993), Mofett (2006) and Harman (2003) offer solutions that take *that*-clauses to sometimes refer to entities other than propositions. The solution offered here is distinct from theirs, because we deny that *that*-clauses refer to entities. We will see that our proposal is intended to cover where their proposals go right while also being more general.

⁷ By *contentful entities* I mean entities that felicitously take *that*-clauses as complements such as *the rumor that P*, *the evidence that P*, *the thesis that P*, *the statement that P*. The expressions that refer to these entities are called *content nouns* in the linguistics literature (Moulton, 2009: §2.2).

relation to the proposition that Fido barks. As Sally can fear the proposition that Fido barks⁸ without fearing her dog barking, (3-a) and (3-b) express different propositions. According to King, *fear* expresses one relation when it occurs in (3-a), and another relation when it occurs in (3-b). Since these two instances of *fear* express different relations, we cannot substitute them for each other and Prior's puzzle is resolved.

King comes to this solution by elimination of alternatives. On the one hand, SSV is an important principle of compositional semantics. If Prior's puzzle can be explained without giving it up, those explanations should be preferred. King's solution does not violate SSV, because *fear* is not coreferential, when it occurs in (3-a) and (3-b). On the other hand, King rejects the possibility that *that*-clauses and proposition descriptions refer to different types of entities. Not only is there evidence that they do refer to entities of the same type (as briefly discussed in §1 above), but denying this does not informatively explain why Prior's puzzle arises in the first place (2002: 347-351). According to the King, the polysemy view is the best available solution.

3. Nebel's Solution

Nebel (2019) rejects King's polysemy solution. Nebel proposes a view that targets the meaning of contentful entity descriptions such as *the proposition that P*, *the rumor that P* and *the statement that P*.

It is instructive to begin by considering why Nebel rejects King's view. One way to test polysemy is called *thezeugma test*. For instance, the verb *call* is polysemous. To check this, we can consider how two instances of *call* with purportedly different meanings combine in a single instance. If the combination sounds odd, this is *prima facie* evidence that two instances do not express the same meaning. Consider (4):

- (4) a. Sally called my bluff.
- b. Sally called her grandmother.
- c. ?? Sally called my bluff and her grandmother.

The reason why (4-c) sounds rather odd is because the verb *call* expresses two different relations in (4-a) and (4-b). Trying to force these different meanings into a single instance of *call* results in the oddity of (4-c). If, as King claims, an attitudinal verb such as *fear* is also polysemous, then we should

⁸ Of course, *fearing the proposition that Fido barks* sounds nonsensical. How can one fear a proposition? This is exactly the point. According to King, the relation expressed by *fear* in (3-b) generates a nonsensical meaning, whereas the relation expressed by *fear* in (3-a) does not..

expect a similar effect when we combine two instances of *fear*. Nebel points out that this is not what we find (2019: 77):

- (5) a. Carlos fears snakes.
- b. Carlos fears that snakes might show up in his house.
- c. Carlos fears **snakes** and **that they might show up in his house**.

Since the relations expressed by *fear* in (5-a) and (5-b) felicitously combine into a single instance in (5-c), this constitutes evidence against *fear* being polysemous, and hence against King's approach.⁹

Finding King's account lacking, Nebel proposes an explanation that targets the meaning of complements for attitudinal verbs. Here we have two options: either say something about the meaning of *that*-clauses or contentful entity descriptions. Nebel takes the latter route. His proposal consists in rejecting that contentful entity descriptions such as *the proposition that P*, *the rumor that P*, and *the evidence that P* refer to the entities they seem to. This sounds counterintuitive: it denies, for instance, that the rumor description *the rumor that Fido barks* refers to a rumor.

Nebel motivates his solution by appealing to an analogous solution for *Partee's puzzle* (Partee, 1974). Partee's puzzle can be illustrated with the strangeness of the following argument:

- (6) a. The number of insect species on Earth is increasing.
- b. The number of insect species on Earth is 5.5 million.
- c. Therefore, 5.5 million is increasing.

⁹ Does this *establish* (rather than merely provide evidence) that *fear* is not polysemous? The *zeugma* test for establishing or rejecting polysemy might not suffice to settle the existence of polysemy. The regular examples of zeugma to *establish* polysemy are straightforward as seen in (4). However, the *lack* of oddity or zeugma might not be sufficient to establish univocality, since there seem to be examples where there is no zeugma, but polysemy might still be needed:

- (i) a. I believe my mother.
- b. I believe that my mother helped the neighbors.
- c. I believe my mother and that she helped the neighbors.

Here (i-a-b) unify into a single felicitous instance; yet Nebel's account of the synonymy of (2a-b) in Prior's puzzle depends on a claim of polysemy for the verb *believe*. Nebel himself (2019: 97) finds a variant of (i-c) strange: "I believe my mother and that Fido barks". I am tempted to think this is due to the irrelevant-sounding complements in the examples he uses. If we have some anaphora in the *that*-clause complementing *believe*, his examples sound fine. I am therefore inclined to think that *zeugma* test might not suffice to establish univocality, even though it might suffice to establish polysemy. If this is also reader's suspicion, they can read my argument as specifically targeting Nebel, who takes the zeugma test to be conclusive against King's account. Thanks to Ian Phillips for questioning the zeugma test and for detailed discussion.

If the noun phrase *the number of insect species on Earth* referred to the number 5.5 million, then (6) would be valid, since the argument uses only identity elimination. But the conclusion (6c) is obviously false even though (6a-b) sound true. Something must give. The way out of this puzzle is to concede that the noun phrase *the number of insect species on Earth* does not refer to a number. Instead, it refers to *an individual concept*—a function that takes a situation of evaluation and returns the number of insect species on Earth in that situation. In addition, in (6b) the copula *is* is not the copula of identity: it does not identify the individual concept expressed by *the number of insect species on Earth* with a number. Instead, the copula *is* merely specifies the value of the individual concept at that situation. (6c) does not follow from such an interpretation of (6a-b) and Partee’s puzzle is resolved.¹⁰

Nebel extends this solution to contentful entity descriptions. In his view, contentful entity descriptions such as *the proposition that Fido barks*, *the rumor that Fido barks*, or *the evidence that Fido barks* do not refer to a proposition, rumor or evidence, but instead to propositional concepts that take a situation of evaluation and return a proposition, rumor or evidence that Fido barks in a given situation. As Nebel maintains the thesis that *that*-clauses refer to propositions, *that*-clauses and proposition descriptions refer to different entities under Nebel’s proposal. Prior’s puzzle is thereby resolved according to Nebel without abandoning SSV. Recall (3):

- (3) a. Sally fears that Fido barks.
- b. Sally fears the proposition that Fido barks.

In (3-a) Sally stands in a fear relation to a proposition, whereas in (3-b) Sally stands in a fear relation to a propositional concept. Since a propositional concept is never identical to a proposition, they make different contributions to (3-a) and (3-b). This is why (3-a) and (3-b) express different propositions.

However, this solution, as it stands, also predicts that (2-a) and (2-b) express different propositions:

- (2) a. Sally believes that Fido barks.
- b. Sally believes the proposition that Fido barks.

Yet they do not. Nebel explains the preservation of meaning by appealing to the special status of

¹⁰ Nebel attributes this solution jointly to Montague (1974) and Higgins (1973).

the verb *believe*. *Believe* seems to be special in that, even when it is complemented by an obviously non-proposition-denoting noun, a token utterance such as (7) still manages to relate the subject to a proposition:

- (7) Carlos believes his mother.

(7) means that Carlos believes a proposition associated with his mother, even though *his mother* in (7) does not refer to a proposition. Considering examples such as (7), Nebel is happy to accept any analysis of the verb *believe* which explains how this is so. In particular, he ends up hesitantly endorsing the polysemy of *believe* (Nebel, 2019: §5.3). This solution stipulates that *believe* expresses two different relations: (i) one that takes a proposition and returns a predicate that is true of an individual who believes that proposition just in case that individual believes that proposition; and (ii) one that takes a non-propositional entity like Carlos' mother and returns a predicate that is true of an individual just in case the individual believes a contextually salient proposition associated with Carlos' mother. Since this seems to be an independent fact about the verb *believe*, Nebel suggests that propositional concepts in the context of *believe* can still be associated with propositions without denoting them, just as the expression *Carlos' mother* in (7) in the context of belief can be associated with a salient proposition.

4. The Problem of Causal Predicates for Nebel

I now argue that Nebel's proposal makes bad predictions about the interaction of contentful entity descriptions and causal predicates, and that most obvious ways to avoiding this problem subjects Nebel to the same objection he levels against King.

Nebel's proposal does not only apply to proposition descriptions, but also to all other contentful entity descriptions, since he wants to unify all contentful descriptions under one proposal (2019: 90). For instance, a rumor description *the rumor that P* or a statement description *the statement that P* does not refer to a rumor or a statement, but to a propositional concept that takes a situation and returns a proposition rumored or stated to be true in that situation. This is where his account goes wrong. Consider the following:

- (8) a. The rumor that John embezzled from the company hurt Mary.
b. The rumor that John embezzled from the company surprised Mary.
c. The statement that John embezzled from the company hurt Mary.

- d. The statement that John embezzled from the company surprised Mary.

Here (8-a-d) express a causal relation between a certain statement or rumor and Mary. On Nebel's proposal *the rumor that P* and *the statement that P* refer to propositional concepts. Propositional concepts are abstract functions. We cannot be hurt or surprised by them.¹¹ Since contentful entity descriptions in (8-a-d) all refer to propositional concepts, Nebel's account must always predict that the propositions expressed by these sentences are false. But (8-a-d) can obviously be true in certain contexts. Nebel's proposal fails to allow that sentences combining contentful entity descriptions with causal predicates can ever express true propositions.¹²

Nebel can respond by postulating polysemy for causal predicates. For instance, he might say that the relations expressed by these verbs sometimes relate a propositional concept to an entity and sometimes relate an entity to an entity. He might say that *hurt* means one thing, when it is complemented by a term denoting a propositional concept, e.g. *the rumor that Fido barks*, another thing, when it is complemented by terms denoting entities, e.g. *Mary* and *Mary's mother*. The former type of causal predicates can express the causal relation between the *value* of a given propositional concept, e.g. a rumor, and some entity. For instance, (8-a) will be true, when the value of the propositional function, a rumor, hurts Mary. In general, Nebel can say that (8-a-d) will be true with the causal verbs expressing a relation between a propositional concept and an entity whenever the *value* of the propositional concept, e.g., a rumor or statement, stands in the specified causal relation to the entity in question.

Unfortunately, this defense would subject Nebel to the same objection that Nebel levels against King (2019: 77). Recall (5):

- (5) c. Carlos fears **snakes** and **that they might show up in his house**.

¹¹ van Elswyk (forthcoming) notes but does not develop this worry for Nebel, with reference to Moltmann (2003).

¹² For the objection against Nebel to succeed, all that is required is a distinction between the role propositional concepts play in linguistic theories, which are abstract and the types of things that cannot *prima facie* stand in causal relations, and other contentful entities which can. Of course, there is still the metaphysical question about what exactly contentful entities are. What kind of a thing is a rumor or a statement such that it can hurt or surprise someone, while propositional concepts cannot? Are they utterance tokens of the type *rumor* or a more general type? (For the *type-token* distinction, see Wetzel 2018.) Do they belong to a social ontology where the society postulates the existence of these categories that can stand in these relations, because they find them useful enough to organize the structure of their community? (For an introduction to social ontology, see Epstein 2018).

Nebel used examples like this to argue that, *contra* King, there is no polysemy for attitudinal verbs. But we can make exactly the same case against Nebel. Consider the following:

- (9) a. **Her peers' demeanor** and **the rumor that John stole from the company** hurt Mary.
 b. **Her peers' demeanor** and **the statement that John stole from the company** surprised Mary.

(9a-b) sound neither bad, nor *zeugmatic*. They are plausible sentences in which *hurt* or *surprise* seem to express a single univocal relation of hurting or surprising between the conjunction of some demeanor and rumor/statement, and Mary. This is evidence that we are not dealing with polysemy in causal verbs such as *hurt* or *surprise*.

In response to this worry, Nebel could potentially suggest that causal predicates are univocal, but express relations *both* between entities of the same type *and* between propositional concepts and entities. However, this creates problems of compositionality. Propositional concepts are functional types, whereas entities are entity types. If causal predicates are defined to express relations between entities, then propositional concepts cannot compose with them, due to not matching the type the predicate is defined for. On the other hand, if causal predicates are defined to express relations between propositional concepts and entities, then entities cannot compose with them.¹³ This problem would manifest itself as ungrammaticality in (9a-b). Since it does not so manifest, the defense of univocality in response to the polysemy worry cannot salvage Nebel's positive proposal.

In summary, Nebel's account predicts bad results for the apparently truthful composition of contentful entity descriptions with causal predicates. Arguing for polysemy in causal predicates is not an option for Nebel: his account predicts polysemy for verbs for which there is none.

5. *That Solution*

So far, I have argued that two putative solutions to Prior's puzzle are wanting in different respects. King's polysemy solution is unable to accommodate Nebel's data, whereas Nebel's proposi-

¹³ In Montagovian type theory (1973; for a textbook exposition, see Gamut, 1999: 81–122) where *e* is the type of entities, *s* is the type of possible worlds and *t* is the type of truth values, causal verbs can either be of type $\langle e, \langle e, t \rangle \rangle$, which takes a pair of entities to a truth value or they can be $\langle \langle s, \langle s, t \rangle \rangle, \langle e, t \rangle \rangle$ which takes a pair of propositional concepts and entities to a truth value. However, in order for causal predicates to be univocal in being of either type, the type *e*, the set of entities, and type $\langle s, \langle s, t \rangle \rangle$, the set of propositional concepts, must be identical. This is absurd.

tional-concept solution cannot account for the truthful composition of causal predicates. I now provide a solution to Prior's puzzle which focuses on the meaning of *that*-clauses and avoids the objections we have seen so far.¹⁴

An assumption shared by King and Nebel is that *that*-clauses are singular terms that refer to propositions. However, *that*-clauses do not specify their reference explicitly, unlike contentful entity descriptions such as *the rumor that P* and *the proposition that P*. The most we can infer from their occurrence in an expression is that they take propositional contents as arguments, i.e., *that P*, rather than referring to propositions. Thus, there is *prima facie* reason to question whether they refer to propositions.

Recent linguistic work on complementizers spearheaded by Kratzer (2006) substantiates this suspicion. The clearest reason why *that*-clauses might not refer to propositions is the felicitous composition of *that*-clauses with content nouns such as *statement*, *rumor*, *proposition*:

- (8) a. **The rumor that John embezzled from the company** hurt Mary.
- c. **The statement that John embezzled from the company** hurt Mary.

A singular term cannot grammatically modify a noun as *that*-clauses seem to do in (8a-c).¹⁵ If *that*-clauses do not refer to propositions, what do they do? I first explore a positive view that *that*-clauses denote predicates of contentful entities and show that this view provides a solution to Prior's puzzle that avoids the problems faced by King and Nebel. I then respond to challenges.

The role of a predicate is to express some property of an individual or a relation among individuals. The predicate *run*, for instance, expresses the property of running of some salient entity. Predicates are contrasted with expressions that denote individuals and serve as arguments of predicates.¹⁶ *That*-clauses can be defined as predicates that express relations between contentful entities and their contents. They relate a contentful entity like *rumor*, *statement* or *proposition* to its content expressed by the sentence complementing the *that*-clause. In effect: they say what the content of the contentful entity is. For instance, spelling out the meaning of *the statement that P*, *that*-clause takes a statement and describes the content of this statement, which is the proposition expressed by *P*. So,

¹⁴ The proposal has its roots in Kratzer (2006). It has been further developed in Moulton (2009).

¹⁵ There are technical fixes that make this possible (see especially Potts 2002). But such fixes lead to problems that are analogous to the problems we have raised for Nebel (see Moulton 2009: 36).

¹⁶ The distinction goes back to Frege (1951) and was sharpened in Strawson (1959).

the function of *that*-clauses is not to refer to propositions, but “to describe a thing whose content is expressed by the proposition that [P]”. (Moulton, 2009: 36).

Since under such a construal *that*-clauses do not refer to propositions, we can, *contra* Nebel, retain the view that entity descriptions refer to their entities and still resolve Prior’s puzzle. This way the causal worry does not arise, because *the rumor that P* refers to a rumor that can truthfully compose with causal predicates rather than to abstract propositional functions which cannot. However, the solution to Prior’s puzzle requires us to explain how *that*-clauses *qua* predicates can compose with attitudinal verbs.

We have assumed in the introduction that attitudinal verbs such as *fear* and *believe* express two-place relations between individuals who hold the attitude and the content of the attitude. Since *that*-clauses are predicates that express relations under the present proposal and relations are not the type of entities that occupy the argument places of predicates, they cannot fulfill the role of individuals that the holder of an attitude stands in a relation to. *That*-clauses must interact with attitudinal verbs in a different way.

Kratzer showed by relying on *predicate restriction* (Ladusaw and Chung, 2003) how predicational *that*-clauses interact with attitudinal relations. Predicate restriction is an operation that combines two predicates without saturating either predicate. Combination restricts the domain of one predicate to a subdomain whose elements fall under the restricting predicate. An example might make this idea more concrete. *Love* expresses a two-place universal love relation between two entities of all kinds. But we can also talk about a more specific relation of love, for instance, love of cats. The way to obtain this relation is to take the property expressed by *cat* and restrict the domain of the second argument to a subdomain consisting only of cats. The result is still a predicate which must be saturated by two entities to express a proposition, but the second argument can only be saturated by entities the predicate *cat* applies to.

Predicate restriction is different from the regular mode of composition for predicates in that it combines two predicates and returns another predicate rather than occupying the unsaturated argument places of a predicate and preventing it from further composition. When a predicate is saturated, it is no longer a predicate that has available argument places for composition. But when a predicate is restricted, it is still a predicate that can be composed in the same way as it was before restriction. Now we illustrate how this comes about when we apply predicate restriction to attitudinal verbs and *that*-clauses. Consider (3):

- (3) a. Sally fears that Fido barks.

Take the meaning of *fear* to be a two-place predicate between individuals and contentful entities:¹⁷

$$(10) \quad [[\text{fear}]] = \lambda s . \lambda x_c . \text{fear}(s, x_c)$$

where s is an individual and x_c is a contentful entity. (10) reiterates the relational analysis of *fear*. The analysis of *that*-clauses just given is expressed as follows:

$$(11) \quad [[\text{that}]] = \lambda x_c . \lambda p . \text{cont}(x_c) = p$$

where p is a proposition and *cont* is a function that takes the contentful entity and returns the propositional content of the entity. The meaning of *that*-clause is a two-place relation that equates the propositional content of a contentful entity such as a rumor, statement or proposition with the proposition expressed by the sentence complement in the *that*-clause. To reiterate, this contrasts with the referential analyses of *that*-clauses. Unlike King's or Nebel's analysis, *that*-clauses are not singular terms that refer to propositions—they are predicates denoting relations between contentful entities and propositions expressed by sentences complementing *that*-clauses.

When we interpret (3-a) with (10) and (11), we obtain (12):

$$(12) \quad [[\text{Sally fears that Fido barks}]] = \\ \lambda x_c . (\text{fear}(\text{Sally}, x_c) \wedge \text{cont}(x_c) = [[\text{Fido barks}]])$$

Note that the meaning of (3-a) as given in (12) is not a proposition, because there is still an unsaturated argument place in (12), i.e. the lambda variable x_c . This means the *that*-clause does not occupy the content argument of the fear relation and generate a proposition, as it would under proposals that take *that*-clauses to be referring expressions. It merely restricts the range of what the content argument x_c can be. Whatever occupies the content argument x_c , its content is the proposition expressed by *Fido barks*. But if so, (12) is not a proposition that can be true or false, but only a predicate that has a truth-value only when it is saturated by some entity. Following Kratzer (2006: §6), we

¹⁷ $[[\cdot]]$ is the interpretation function which maps expressions to their meanings. I use the lambda expressions to denote predicates that can be saturated by entities of the specified type. For instance, the meaning of the predicate *run* is expressed as $\lambda s . \text{run}(s)$ where s stands for the type of entities. Also the assumption *that* x_c is a contentful entity is for convenience. It is clear that the relation expressed by *fear* can take non-contentful entities as arguments, too, as in: *Carlos fears snakes*.

turn (12) into a proposition by taking the existential closure of (12). This is tantamount to saying that the meaning of (3-a) presupposes that there is a contentful entity whose content is the proposition that Fido barks without explicitly specifying what the contentful entity is. We can encode this presupposition by existentially closing (12), which gives us (13):

$$(13) \quad \exists x_c (fear(Sally, x_c) \wedge cont(x_c) = [[Fido \text{ barks}]])$$

(13) is true just in case there is some contentful entity whose content is the proposition expressed by *Fido barks* and Sally stands in a fear relation to that contentful entity. Importantly, this contentful entity does not have to be a proposition. It can be anything that can play the role of a contentful entity Sally stands in a fear relation to. This contrasts with the meaning of (3-b) as expressed in (14):

$$(14) \quad [[Sally \text{ fears the proposition that Fido barks}]] = \\ fear(Sally, p) \wedge cont(p) = [[Fido \text{ barks}]]$$

where p denotes the proposition predicated by *that Fido barks*. (14) is true just in case Sally stands in a fear relation to the proposition that Fido barks.

Now we can illustrate how we resolve Prior's puzzle. (13) is the meaning of (3-a) and (14) is the meaning of (3-b):

- (3) a. Sally fears that Fido barks.
- b. Sally fears the proposition that Fido barks.

(13) is true just in case there is some contentful entity whose content is the proposition that Fido barks and Sally stands in a fear relation to that entity. Importantly, this contentful entity does not have to be a proposition. On the other hand, (14) is true *only if* the contentful entity that Sally stands in a fear relation to is the proposition that Fido barks. For instance, if Sally fears the possibility that Fido barks, (13) winds up true, whereas (14)—false. Thus we predict distinct truth-conditions for (3-a) and (3-b) and explain why (3-a) can be true, while (3-b)—false. Hence we resolve Prior's puzzle

without postulating polysemy (*contra* King), falling short of accounting for causal predicates (*contra* Nebel) or giving up SSV.¹⁸

6. An objection

But this analysis faces its own objection. If Sally fears the proposition that Fido barks, then (14) entails (13) via existential generalization. If (13) is the meaning of (3-a), then the proposition expressed by *Fido fears the proposition that Fido barks* entails the proposition expressed by *Sally fears that Fido barks*. Can Sally not fear the proposition that Fido barks without fearing that Fido barks? In the case of *fear* this is not exactly clear, because it is hard to imagine how one can fear a proposition at all. The case of *know* illustrates this concern better. Consider (15):

(15) Sally knows that Fido barks.

Taking a relational analysis of *know*, (15) can be interpreted as follows:

(16) $[[\text{Sally knows that Fido barks}]] =$
 $\lambda x_c. (\text{know}(\text{Sally}, x_c) \wedge \text{cont}(x_c) = [[\text{Fido barks}]])$

Taking the existential closure of (16) as in (13), we obtain (17):

(17) $\exists x_c (\text{know}(\text{Sally}, x_c) \wedge \text{cont}(x_c) = [[\text{Fido barks}]])$

And (17) is true if Sally stands in a knowledge relation to something whose content is the proposition that Fido barks. However, this interpretation is too weak. For instance, if Sally knows the proposition that Fido barks, then this entails the truth of (17). But Sally knowing the proposition

¹⁸ An anonymous reviewer helpfully inquires what happens to Partee's puzzle under the current account, since sentences like *the number of insect species on Earth surprised Mary* seems to give rise to similar puzzles. I believe we can give a similar treatment for the example mentioned. For the expression *the number of* in particular, we might help ourselves to a meta-language function $\#$ similar to *cont* in (11) that takes the actual size of a collection of countable entities (instead of contentful entities) and returns a contextually specified cardinal number. The meaning of *the number of* would be a predicate equating the size of the collection to the cardinal number specified. The predicate *surprise* is then saturated by the size of the collection in question, which seems to be the right kind of entity for a causal predicate. This analysis gives rise to an ambiguity, which can be confirmed to exist. The interpretation that the size of the collection of insect species on Earth is such that its number is n and it surprised Mary is true. However, the interpretation that the number n is such that it is the number of the size of the collection of insect species on Earth and it surprised Mary is false. I take the prediction of such ambiguity a good result for our analysis.

that Fido barks is not sufficient for her to know that Fido barks. She also needs to know that this proposition is true. In other words, the contentful entity she knows must be factive. The case of *know* illustrates that (17) as the meaning of (15) is too weak. (17) can too easily be true, whereas (15) requires for its truth a *factive* contentful entity whose content is the proposition for *Fido barks*. So, not any garden-variety contentful entity suffices for the correct meaning of (15).

This issue can be resolved by imposing a restriction on the existential closure for lambda expressions. We said that the meaning of a sentence with an attitudinal verb complemented by a *that*-clause presupposes the existence of a contentful entity *without specifying what that contentful entity is*. This assumption is too weak. The existence of the contentful entity has to satisfy certain desiderata determined by the attitudinal relation expressed. For instance, if someone knows that P, whatever they know must satisfy certain criteria. As knowledge is factive, the content of what they know must be factive. The factivity of knowledge places constraints on the kinds of contentful entities presupposed to be known.

In our analysis, this can be expressed by a restriction on the domain of the existential quantifier, when existentially closing lambda expressions. In particular, we have to restrict the range of the existential quantifier to a subset of contentful entities. This subset is specified by the attitudinal verbs which contentful entities are complementing.¹⁹ This would mean that the existential closure of (16) is not (17), but (18):

- $$\begin{aligned}
 (16) \quad & [[\text{Sally knows that Fido barks}]] = \\
 & \lambda x_c. (\text{know}(\text{Sally}, x_c) \wedge \text{cont}(x_c) = [[\text{Fido barks}]]) \\
 (17) \quad & \exists x_c (\text{know}(\text{Sally}, x_c) \wedge \text{cont}(x_c) = [[\text{Fido barks}]]) \\
 (18) \quad & \exists x_c \in D_{\text{know}} (\text{know}(\text{Sally}, x_c) \wedge \text{cont}(x_c) = [[\text{Fido barks}]])
 \end{aligned}$$

where D_{know} is a subset of the set of all contentful entities for the verb *know*. Since *know* is factive, D_{know} must include only factive contentful entities, e.g., *the fact that P*.²⁰ This resolves the problem, because not everything that can be known has the desired factivity to qualify for membership of D_{know} . To compare, take the following:

¹⁹ The finest-grained way of specifying such subsets would be to let each attitudinal verb determine its own subset of contentful entities. However, as Anand and Hacquard (2014) show, there may be generalizations that hold among verbs, too. For instance, cognitive factives such as *know*, *discover*, and *realize* presuppose the truth of the content of their *that*-clauses, so their domains will consist of factive contentful entities.

²⁰ Kratzer (2006: §9) divides *that*-clauses into categories according to their role, e.g., *logophoric that-clauses*, *factive that-clauses*. Our treatment here captures this by postulating a restricted existential closure of the predicational form.

(19) Sally knows the proposition that Fido barks.

$$know(Sally, p) \wedge cont(p) = [[\text{Fido barks}]]$$

The proposition description *the proposition that Fido barks* does not have the desired factivity to belong to D_{know} . Hence the existential generalization of (19) will not be (18), but (20):

(20) $\exists x_c(know(Sally, x_c) \wedge cont(x_c) = [[\text{Fido barks}]])$

The existential quantifier in (20) quantifies over the set of all contentful entities, not merely over the subset for *know*. What this implies is that there may be situations where (20) is true, whereas (18) is not. These situations may be those where someone merely knows something, e.g. a possibility or a proposition, whose content is the proposition that Fido barks. Note that propositions and possibilities are not the type of entity that possess the property of factivity required by the knowledge relation. So, the truth-conditions for *know that P* and *know the proposition that P* will be distinct and (19) will not entail (18) as desired.²¹

This analysis also helps us tackle an issue that arise for proper names referring to contentful entities:²²

- (21) a. Gödel fears that mathematics reduces to logic.
b. Gödel fears logicism.

Apparently, (21-a) does not entail (21-b). (21-a) is interpreted under the present account as saying that there is a contentful entity appropriate for the predicate *fear* and Gödel fears that. Without going into an exhaustive inquiry about what kinds of entities are salient for the subdomain of *fear*, we can

²¹ Assumption of distinct contentful entities for distinct attitudinal verbs may seem like our solution to Prior's puzzle is closer to Parsons (1993), Mofett (2006) and Harman (2003) who argue that *that*-clauses sometimes refer to entities other than propositions than I acknowledge. However, this is not the case. Under our solution *that*-clauses are not referring expressions at all. They are predicates that associate the propositional content of many different entities selected by their attitudinal verbs with their propositional content. Our analysis assigns a uniform meaning to *that*-clauses rather than stipulating that they refer to different entities in different contexts. I believe that our analysis is more explanatory, because it assigns the same meaning to an expression which occurs *verbatim* in different contexts, while varying the implicit contentful entities with the varying attitudinal verbs. Thanks to an anonymous referee for pressing me to clarify the difference among these analyses and ours.

²² Thanks to an anonymous reviewer for rightfully questioning if the present solution extends to proper name variants of Prior's puzzle. Examples are from Nebel (2019, p. 93).

for this example assume that future prospects qualify for it (also see (5) above which further supports this assumption). (21-a) roughly means that Gödel fears the prospect that mathematics reduces to logic, but proper noun *logicism* does not refer to a prospect, but to a particular thesis whose propositional content is that mathematics reduces to logic. So, the entailment does not go through under the present account, as it should not, if the subdomains attitudinal verbs introduce for their contentful entities are carefully tracked.

This objection invites an inquiry into the composition of contentful entities and attitudinal relations. Certain attitudinal verbs such as *hope for* are unproductive in that they seem to compose truthfully only with a handful of contentful entity descriptions:

- (22) a. Sally hopes for the eventuality that Fido barks.
- b. ?? Sally hopes for the proposition that Fido barks.
- c. ?? Sally hopes for the rumor that Fido barks.
- d. ?? Sally hopes for the hypothesis that Fido barks.

Others such as *believe* are highly productive:

- (23) a. Sally believes the proposition that Fido barks.
- b. ?? Sally believes the eventuality that Fido barks.
- c. Sally believes the rumor that Fido barks.
- d. Sally believes the hypothesis that Fido barks.

It is plausible that an extension of Anand and Hacquard's proposal (2014) can explain the discrepancy in the productivity of attitudinal verbs by finding more general categories that group complements of attitude verbs. The result of any such inquiry can provide further insight into what the subdomains for existential closures of lambda expressions should be.

We have resolved Prior's puzzle. It remains only to say something about the verb *believe*. Specifically, we owe an analysis of why (2-a) and (2-b) sound equivalent:

- (2) a. Sally believes that Fido barks.
- b. Sally believes the proposition that Fido barks.

while also saying why (7) is fine:

(7) Carlos believes his mother.

First, I explain (2). The equivalence of (2-a) and (2-b) is explained by the restriction we have introduced for the existential closure. It just so happens that the subdomain *believe* has for the set of contentful entities corresponds to the set of entities denoted by propositional descriptions. This is why (2-a) defaults to an interpretation that is equivalent to (2-b) and why (2-a) and (2-b) are interpreted as equivalent.

(7) can also be explained by a contextual association of a proposition with Carlos' mother. This can be implemented in two ways. For instance, one can postulate polysemy for *believe*:

- (24) a. $[[\text{believe}_1]] = \lambda \mathcal{R} . \lambda s . \lambda o . \lambda x_c . (\text{believe}(s, x_c) \wedge \mathcal{R}(o, x_c))$
 b. $[[\text{believe}_2]] = \lambda s . \lambda x_c . \text{believe}(s, x_c)$

Here o is an entity and \mathcal{R} is a relation that associates an entity such as Carlos' mother to a contentful entity such as some proposition contextually associated with Carlos' mother. Here (24-a) is the interpretation of *believe* that can felicitously take non-propositional objects as argument, whereas takes only contentful entities as argument. So, an occurrence of *believe* without a contentful entity inherits the former interpretation, whereas the one with a contentful entity inherits the latter. Given this polysemy, we can say (7) is interpreted as (24-a).

However, we have seen evidence to doubt polysemy for *belief* in footnote 9. So, a non-polysemy explanation for (7) is preferred. I think this is easily achieved, if we take (24-a) to be the meaning of *believe*. Suppose *believe* is univocal and its interpretation is believe_1 . When o is itself a contentful entity, the relation \mathcal{R} reduces to the identity relation and the interpretation reduces to the more familiar believe_2 . When one says that they believe something that cannot obviously carry any propositional content, e.g. Carlos's mother, they still manage to convey their belief in something with propositional content. The interpretation is that the entity with propositional content is contextually associated with an entity with no propositional content. When Carlos believes his mother, the object of Carlos's belief is not his mother, but a proposition, statement, claim *et cetera*, which is contextually associated with his mother. *Carlos's mother* is used as a proxy to refer to whatever she has previously said or indicated that Carlos now invests his belief in. If the object of belief is something with propositional content, e.g. his mother's statement that she helped the neighbors, the need for such associa-

tion is obviated and the relation \mathcal{R} becomes idle. This would explain how *believe* seems to truthfully compose with non-proposition-denoting entities, while avoiding polysemy.

This completes the discussion of my solution. Before concluding, I would like to discuss a recent development on Prior's puzzle. Justin D'Ambrosio (2020; forthcoming) proposed a very different solution to Prior's puzzle from the ones mentioned so far.²³ D'Ambrosio notes that Prior's puzzle arises, because one takes all expressions in the object language to be referential rather than acknowledging different roles for the referents of these expressions, e.g. the role of a predicate is to predicate, *not* to refer to a predicate in the meta-language. Formulating Prior's puzzle in these terms seems to have some implications for my proposal. First, there is the danger that my account might be subject to certain counterexamples:

- (25) a. Sally fears that Rosco snarls.
 b. Some content-bearing entity is such that Sally fears it and its content is that Rosco snarls.

However, (25-a) does not seem to entail (25-b), even though my account seems like it should predict this entailment. I believe this is not a counterexample to my account, because my proposal is formulated by paying special attention to how attitude verbs determine special subdomains of contentful entities (as was needed to solve the problem of the verb *know* above). So, taking this detail into account, a more faithful translation of (25-b) would be:

- (25) c. Some future prospect is such that Sally fears it and its content is that Rosco snarls.

The truth-conditions for (25-c) can be understood to follow from (25-a). This response raises the important question whether there is always some content-bearing entity for each attitudinal verb.²⁴ A full answer to this question is impossible to attempt here, but some considerations point in the direction of a positive answer. One consideration is the wide-ranging data that come from existential generalization of *that*-clauses:

²³ Thanks to an anonymous reviewer for drawing my attention to this development and the following discussion.

²⁴ Thanks to an anonymous reviewer for pressing on this question.

(26) John: I believe that everyone should have access to fair education. [*Context: Sally and Berta miss the sentence after the that-clause.*]

Sally: What does John believe?

Berta: He believes something, but I didn't hear what.

Here Berta's response is very natural and examples might be multiplied for various attitude verbs easily. As I see it, the existence assumption of contentful entities for attitude verbs is safe to make until a counterexample is found that can witness the would-be felicity of Berta's response in (27):

(27) John: Claribelle φ 's that everyone should have access to fair education.

Berta: There is nothing Claribelle φ 's/Claribelle φ 's nothing.

I cannot think of an example that can felicitously suit this pattern. Until such an example is found, I do not see any harm in assuming that there is always a content-bearing entity suitable for attitude verbs.

Another consequence of conceiving Prior's puzzle in the way suggested by D'Ambrosio is that similar phenomena can be crafted from various types of expressions:

- (28)
- a. Sally forgot who came to the party.
 - b. Sally forgot the question of who came to the party.
 - c. Sally became wise.
 - d. Sally became the property of wise.

The substitutions from (28-a-c) to (28-b-d) do indeed seem to give rise to Prior-like puzzles. Further it appears that the solution to the puzzle in (28) begs a solution that requires distinguishing the reference of meta-linguistic expressions from that of object-language expressions. The way we have solved Prior's puzzle is by proposing that *that*-clauses predicate of implicit contentful entities determined by the attitudinal verbs in question. It is not clear whether a similar strategy can be applied to the sort of expressions that give rise to puzzles in (28). For instance, can there be a function similar to *cont* in (11) that takes temporal stages of someone having a certain psychological makeup and returns the abstract property *wise*? Such a treatment would predict ambiguity along the lines discussed in footnote 18. The data in (28) is fascinating either way and should be ultimately accommodated by any putative solution to Prior's puzzle. I do not have a complete solution to offer at the

moment, but there are certain considerations arising from our analysis of Prior’s puzzle that may be problematic for D’Ambrosio’s solution.

Our solution to Prior’s puzzle makes some fine-grained predictions about felicity of verbs grammatically embedding *that*-clauses. For instance, there seems to be a difference between (29a) and (29b):

- (29) a. John saw and Sally heard that there was an explosion.
 b. ?? John read and Sally smelled that there was an explosion.

(29-a) is noticeably better than (29-b). The explanation under our account would be that for (29-a) there is overlap between the subdomains of contentful entities for *see* and *hear* and this leads to some common contentful entity that can truthfully compose with both seeing and hearing. However, this is not the case for (29-b). The current account predicts that there will be a spectrum of felicity arising from the intersection of subdomains for verbs embedding content nouns. It is hard to see how one can explain the data without acknowledging the fine-grained semantic relations between contentful entities and attitude verbs. In sum, I acknowledge that D’Ambrosio’s data in (28) must eventually be handled and it is not clear whether the present account can do so. However, our account also makes certain predictions about attitude verbs that do not seem straightforward to account for given D’Ambrosio’s solution. An ultimate solution will have to account for both the fine-grained facts about attitudes predicted by our solution and quantificational puzzles predicted by D’Ambrosio.

7. Conclusion

A satisfactory resolution to Prior’s puzzle should respect advances in linguistics about contentful entities and *that*-clauses. In this paper I have attempted to show that a Kratzerian view of *that*-clauses (with some bells and whistles) not only resolves Prior’s puzzle, but it does so while avoiding the problems which beset other recent attempts to solve the puzzle. There are some natural ways this proposal can be enriched. It would be desirable to find general categories to which subsets of contentful entities belong, as required by attitudinal verbs in line with Anand and Hacquard’s (2014) analysis. Moreover, I have only focused on the linguistic aspect of why certain attitudinal verbs default to certain contentful entities. More inquiry is needed into the psychological aspect of how mental attitudes impact the selection of contentful entities in accordance with the relations ex-

pressed by attitudinal verbs. For instance, there is a story to be told about the mental attitude of belief which enables the equivalence of (2-a) and (2-b).

Let me end with a note about a general upshot of the paper. *Britannica* defines *propositional* attitudes to be “verb[s] that may take a subordinate clause beginning with ‘that’ as its complement” and says that “verbs such as ‘believe’, ‘hope’, ‘fear’, ‘desire’, ‘intend’ and ‘know’ all express propositional attitudes.”²⁵ Our solution to Prior’s puzzle requires some adjustment to this definition. We have supposed for our solution to Prior’s puzzle that *that*-clauses merely describe contentful entities—they are not singular terms denoting propositions. If our solution is on the right track, then *Britannica* is mistaken in calling any attitudinal verb with a complementing *that*-clause a ***propositional*** attitude.

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