

PRIOR'S PUZZLE GENERALIZED

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Prior's puzzle is the puzzle of why, given the assumption that *that*-clauses denote propositions, substitution of "the proposition that *P*" for "that *P*" within the complements of many propositional attitude verbs is invalid. I show that there are two variants on Prior's puzzle—a quantificational variant and a pronominal variant—that have the same source and warrant the same solution as the original puzzle. I then show that neither the original puzzle nor its variants are specific to *that*-clauses or propositional attitude verbs. Rather, they arise in the complements of *all* attitude verbs, in adjectival positions, in adverbial positions, and in a variety of other positions as well. These variants, together with the generalization to other grammatical categories, show that a wide range of proposed solutions to Prior's puzzle fail, or are radically incomplete. I then discuss one view that stands to solve the generalized puzzle.

1. Prior's Puzzle

The standard theory of propositional attitude verbs is that they denote binary relations between agents and propositions. A sentence of the form "S Vs that *P*" is true iff the subject referred to by S stands in the relation V to the referent of the *that*-clause, which is a proposition. But if *that*-clauses refer to propositions, we should be able to substitute other, co-referring expressions for *that*-clauses *salva veritate*.¹ But in many cases we cannot. Consider the following pair:

- (1) a. Sally fears that Fido bites.
- b. Sally fears the proposition that Fido bites.

¹We should be able to make such substitutions on the assumption that the positions in which *that*-clauses occur are fully extensional. This is an assumption made by nearly everyone in the debate, and I will make it here, too. Also, throughout I will use the terms "refer" and "denote" interchangeably to pick out the single relation of interpretation used in standard compositional semantic theories. While some views do distinguish between different semantic relations that expressions can bear to their semantic values, the puzzle can be reformulated in terms of those semantic relations.

The standard theory tells us that “that fido bites” refers to a proposition. It also seems clear that “the proposition that Fido bites” refers to a proposition—indeed, the very same proposition. And yet (1-a) can be true while (1-b) is false—Sally does not fear an abstract object. We may call this *Prior’s puzzle*, after Arthur Prior [1971], who first formulated it.

This paper first shows that Prior’s puzzle is not just a puzzle concerning substitutions such as the one above; rather, the puzzle has both quantificational and pronominal variants that have the same source and warrant the same solution as the substitutional version. It then goes on to show that neither the original puzzle nor its variants have anything specifically to do with *that*-clauses or propositional attitude verbs; the propositional case is a special case of a much broader phenomenon that we observe in the complements of *all* kinds of attitude verbs, in adjectival positions, in adverbial positions, and in a variety of other positions as well. The quantificational and pronominal variants of the puzzle, together with the generalization of the puzzle to other grammatical categories, show that a large class of proposed solutions to Prior’s puzzle fail, or are radically incomplete. The paper concludes by discussing a view that stands the best chance of solving the puzzle in its generalized form, and the implications that adopting this view has for our approach to the semantics of attitude verbs.

2. Quantificational and Pronominal Variants of the Puzzle

Prior’s puzzle is typically taken to be a puzzle concerning a distinctive kind of substitution within the complements of propositional attitude verbs—substitution of a propositional description such as “the proposition that P” for its embedded *that*-clause. But Prior’s puzzle has nothing specifically to do with substitutions of this sort. Consider again our example from above:

(2) Sally fears that Fido bites.

Suppose that the *that*-clause in (2) refers to a proposition. We can then generalize over that proposition; (3) follows from (2):

(3) Sally fears something.

But now consider the standard semantics for the existential quantifier in type-

theory:

$$(4) \quad \llbracket \exists u_t \phi \rrbracket^{M, \mathcal{S}} = 1 \text{ iff there is some } a \in D_t \text{ such that } \llbracket \phi \rrbracket^{M, \mathcal{S}_{u_t}^a} = 1$$

In (4), u_t is a variable over the type t , and $\llbracket \phi \rrbracket^{M, \mathcal{S}_{u_t}^a}$ is the result of assigning a to occurrences of u_t in ϕ . Letting p be the type of object denoted by “that fido bites”—the type of propositions—the clause yields that (3) is true iff:

$$(5) \quad \text{There is some } a \in D_p \text{ such that Sally fears } a.$$

But clearly, (5) can be false even when (2) is true; Sally can fear that Fido bites without there being some a in the set of propositions such that Sally fears a . Thus, on the assumption that the standard semantic clause for the existential quantifier is correct, the apparently valid inference from (2) to (3) turns out to be invalid. Moreover, the same problem arises for any semantic clause that treats the quantifier as a nominal quantifier, i.e., a quantifier whose semantics are spelled out in the metalanguage using first-order quantification over sets.²

The invalidity of this quantificational inference has the same source as the invalidity of the substitution in (1); like the substitution of a nominal expression for a *that*-clause, nominal quantification into the complement of “fears” forces “fears” to take on a transitive reading, as opposed to its intended clausal reading. On the transitive reading, the proposition serves as the object feared, as opposed to specifying the content of the state of fearing.

An analogous puzzle can be formulated using pronouns. Consider the following triad:

- (6) a. Sally fears that Fido bites.
- b. Sally fears it.
- c. Bill fears it, too.

If “that Fido bites” is a referring expression, then there seems to be no reason why “it” in (6-b) and (6-c) cannot refer to exactly what the *that*-clause in (6-a) refers to. And yet, if we interpret “it” as referring to the very same object as the *that*-clause, the meanings of (6-b) and (6-c) differ from that of (6-a) in exactly same way we observed in the substitution and quantificational puzzles: they are

²Rosefeldt [2008, p. 316] notes a similar point in his discussion of a proposal due to King [2002], but does not deploy the point in the same way I will here.

interpreted as meaning that Sally and Bill fear an abstract object—in the same “direct-object” sense that Sally might fear her advisor, or fear sharks. Given this change of meaning, (6-b) cannot follow from (6-a), even if “it” and “that Fido bites” co-refer.

The substitutional, quantificational, and pronominal forms of the puzzle are intimately related. If nominal quantification into a position is valid, then substitution of singular terms—including names, definite descriptions, and pronouns such as “it”—will likewise be valid, because these singular terms serve as witnesses for nominal existential quantifiers.³ Conversely, if one can validly substitute nominal expressions in a particular position, then nominal existential quantification into that position will be valid, because the referents of those nominal expressions will be the objects over which nominal existential quantifiers generalize, given the standard semantics. Thus, the validity of nominal substitution and nominal quantification go hand in hand.

The quantificational and pronominal puzzles strengthen the substitutional puzzle in two ways. First, solving these puzzles requires providing an explanation of why nominal quantification and pronominal substitution into the complements of many propositional attitude verbs are not valid. As we will see, many proposed solutions to the original substitution puzzle lack such an explanation, and cannot be generalized to provide one. Second, once a view has explained why nominal quantification into the complements of propositional attitude verbs is invalid, the view needs to provide a different explanation for the validity of inferences such as the one from (2) to (3): solving the quantificational puzzle requires developing a theory of non-nominal quantification, or finding a way to make nominal quantification into such positions valid after all. I discuss such developments in section 5.

3. Generalization to other Non-Nominal Positions

Not only does Prior’s puzzle have both quantificational and pronominal variants, but neither the original puzzle nor its variants are specific to *that*-clauses or propositional attitude verbs. Rather, perfectly analogous puzzles arise in a

³By “witness” I here mean an expression that, when substituted for the existential quantifier, yields a true substitution instance of the quantified sentence.

variety of other positions. Consider the following examples:

- (7) a. Sally seeks a unicorn
 b. Sally seeks the generalized quantifier denoted by “a unicorn”.
- (8) a. Sally investigated who came to the party.
 b. Sally investigated the question who came to the party.⁴
- (9) a. Sally became wise.
 b. Sally became the property of being wise.⁵
- (10) a. Sally painted carefully.
 b. Sally painted the property of events denoted by “carefully”.

On the traditional, Montagovian semantics for the notional reading of an intensional transitive verb, the intensional NP “a unicorn” denotes an intensional generalized quantifier.⁶ But substitution of a description of this semantic value in (7) changes the sentence’s truth-conditions—(7-a) can be true while (7-b) is false. Similarly, substitution of a description of the question denoted by the *wh*-phrase in (8) changes the sentence’s truth-conditions: Sally can investigate who came to the party without investigating an abstract object. In (10), while Sally might have become wise, she did not become the property of being wise, and in (11), surely Sally can paint carefully without painting a function from properties to

⁴This substitution admittedly does not sound as strange as the others. However, it makes available a reading on which Sally is investigating an abstract object—a set of propositions—in the same sense that Robert Mueller investigated Donald Trump or a private investigator might investigate a person of interest. To bring out this reading, we might even reformulate the example to say that Sally investigated the set of propositions denoted by “who came to the party”. Readers who are not convinced that even this substitution changes the truth-conditions of (8-a) are invited to reformulate the example using “forget” or “study”.

⁵Friederike Moltmann [2003, 2004] to illustrate what she calls the *objectivization effect*.

⁶This proposal is not uncontroversial. On another account of the notional reading, due to Zimmermann [1993, 2006], intensional NPs denote properties. But the same problem arises for this proposal:

- (11) a. Sally seeks a unicorn.
 b. Sally seeks the property of being a unicorn.

The inference in (11) is invalid, despite the fact that the definite description denotes exactly what the indefinite denotes.

properties.⁷

Further, the quantificational form of the puzzle arises for (7-a)-(10-a) as well. Consider the following inferences:

- (12) a. Sally seeks a unicorn.
b. Sally seeks something.
- (13) a. Sally investigated who came to the party.
b. Sally investigated something.
- (14) a. Sally became wise.
b. Sally became something.
- (15) a. Sally painted carefully.
b. Sally painted somehow.

In each case, application of the standard semantics for the existential yields the following truth-conditions for (12-b)-(15-b), respectively:

- (16) There is some $a \in D_{\langle s, \langle \langle s, \langle e, t \rangle \rangle, t \rangle \rangle}$ such that Sally seeks a .
- (17) There is some $a \in D_{\langle s, \langle s, t \rangle \rangle}$ such that Sally investigated a .
- (18) There is some $a \in D_{\langle s, \langle e, t \rangle \rangle}$ such that Sally became a .
- (19) There is some $a \in D_{\langle \langle e, t \rangle, \langle e, t \rangle \rangle}$ such that Sally painted a .

If these standard truth-conditions for the existential quantifier are correct, then each of the generalizations in (12)-(15) are invalid. Each of (16)-(19) can fail to be satisfied even while (12-a)-(15-a) are true. Again, the problem is that a nominal semantics for the quantifier—specified in a metalanguage that involves first-order quantification over sets—appears to force a shift in the meaning of the verb from a clausal, intransitive reading to a transitive one.

Further, the pronominal form of the puzzle arises in all of these cases again as well.

⁷Of course, no one thinks that “carefully” is a referring expression, so we might disallow such substitutions on the grounds that we cannot substitute referring expressions for obviously non-referring expressions. However, in orthodox type-theory, and in most formal semantic theorizing, there is only one semantic relation that expressions bear to their semantic values, and so such distinctions cannot be drawn.

- (20) a. Sally seeks a unicorn.
b. Sally seeks it.
- (21) a. Sally investigated who came to the party.
b. Sally investigated it.
- (22) a. Sally became wise.
b. Sally became it.
- (23) a. Sally painted carefully.
b. Sally painted it.

In each case, there appears to be no reason why “it” cannot refer to the semantic values of each of the expressions it replaces in (20-a)-(23-a). But even given that “it” refers to these semantic values, the result of substituting it in for the original expression changes the reading of the verb. In (20), the substitution forces “seeks” to take on its specific, relational reading, on which Sally is the agent of a search whose goal is to find the generalized quantifier that “it” denotes. In (21), substitution yields a transitive reading of “investigate”—the same reading on which a private investigator might investigate a person of interest. In (22), substitution forces an identity reading of the copular verb “became”, and in (23), naming the modifier denoted by “carefully” turns “paint” into a transitive verb.

The introduction of the quantificational and pronominal puzzles, together with the fact that the original puzzle and its variants arise in a much wider range of positions than is ordinarily thought, reveals that Prior’s puzzle is much stronger than it is ordinarily taken to be, and has nothing specific to do with propositions, propositional attitudes, or the expressions denoting either.

4. Criticism of Existing Solutions

The conclusions of the last section show that that an entire class of proposed solutions to Prior’s puzzle are either radically incomplete, or fail outright. First, consider the view proposed by King [2002]. On King’s view, the invalidity of (1) is due to an equivocation in the meaning of the attitude verb occasioned by the syntactic difference between the *that*-clause and its corresponding description. This proposal accounts for the invalidity of substitutions such as the one in

(1). However, King himself recognizes that his view does not solve the quantificational puzzle; syntactically, “something” and other such quantifiers are noun phrases, and so King’s view entails that when such quantifiers complement verbs such as “fear”, the verb will receive its direct-object reading. This renders quantification into such positions invalid. But since such generalizations seem obviously valid, King’s proposal is incomplete—it requires supplementation with a theory of non-nominal quantification. It also needs to be extended to the non-propositional case. I discuss the prospects for such supplementation and extension in the next section.

The case is even worse for a more recent proposal due to Jacob Nebel [Forthcoming]. On Nebel’s view, “the proposition that Fido bites” does not refer to a proposition. Rather, it denotes a *propositional concept*—a function from worlds to propositions. Thus, on Nebel’s view, (1-a) can be true while (1-b) is false because they have different internal arguments. This allows Nebel to preserve the view that *that*-clauses refer to propositions, while accounting for the change in truth-value. It also allows him to maintain that propositional attitude verbs are univocal across substitutions such as (23)—the only difference between (1-a) and (1-b) lies in their arguments.

However, Nebel’s proposal fails when it confronts the quantificational and pronominal forms of the puzzle. On Nebel’s view, the invalidity of the substitution results from the fact that *that*-clauses and their corresponding propositional descriptions denote different objects. But this cannot account for the invalidity of nominal quantification into the complement of “fears”, because such quantifiers generalize over the very objects denoted by *that*-clauses. It likewise cannot solve the pronominal form of the puzzle, because the pronoun refers to the very same object denoted by the *that*-clause, and yet substituting the pronoun for the *that*-clause still occasions a change in truth-value. These puzzles leave no room for an explanation that relies on a shift in the verb’s arguments, and so Nebel’s proposal cannot account for them.

Nebel’s view faces further problems as well. Nebel assumes that *that*-clauses are referring expressions, and so quantifiers that replace them must be nominal quantifiers. But since nominal quantification into the complements of PA verbs isn’t valid, Nebel view lacks an explanation for the apparent validity of existential quantifications such as the ones in (12)-(15); Nebel’s view needs, but does

not have, an account of non-nominal quantification. Finally, the arguments that Nebel presents for the view that propositional descriptions denote propositional concepts are specific to the propositional case—they do not generalize to puzzling substitutions in (7)-(10).

The generalization of the puzzle to the non-propositional case also undermines a general strategy for addressing Prior's puzzle adopted by Moffett [2003], Parsons [1993], and Harman [2003]. The strategy first attempts to find the kind of object appropriate to each different attitude by taking note of the kinds of nominal expressions that can be validly substituted into the complement of a verb expressing that attitude. On this approach, while propositions may be the objects of belief, they do not serve as the objects of other attitudes. Rather, the object of a desire might be a state of affairs, the object of a fear a possibility, the object of knowledge a fact, and so on. Once the appropriate type of object is found for each attitude, such views make adjustments in either the semantics of attitude verbs or the semantics of *that*-clauses to account for the puzzling substitution in (1).

Moffett [2003] adopts a strategy of this sort to solve the problem of "doxastic shift", which is, in effect, Prior's puzzle applied to "knows". The problem is that, while one can know that P, it does not follow that one knows the proposition that P; rather, in the sense relevant here, one knows facts, not propositions. Accordingly, Moffett proposes a change in the rule governing predication for verbs like "know". On his view, while *that*-clauses uniformly denote propositions, "knows" triggers a different kind of predication—which Moffett calls "descriptive predication"—on which the predicate "is known by Sally" applies to facts corresponding to propositions, as opposed to propositions themselves. A similar view is developed by Parsons [1993], who holds that in some cases, *that*-clauses denote propositions, while in others they denote corresponding facts that are "determined" by those propositions. Harman [2003], likewise, holds that in cases where we observe the substitution failure, *that*-clauses must denote objects distinct from, but suitably related to propositions.

But this strategy is undermined when we consider the generalization of the puzzle to other grammatical categories. In (7), nominal substitution within the phrasal complement of "seeks" changes the truth-value of the sentence. However, Moffett's view is silent about cases other than that of "know", and does not

appear to generalize. If we attempt to apply Moffett's view to "seeks", we find that there are no particular objects of any kind that Sally seeks of which the predicate "is sought by Sally" can be true. Thus, extending Moffett's semantics to "seeks" forces (7-a) to be false—an unacceptable conclusion. Parsons's view fails for the same reason: there are no particular objects that correspond to a generalized quantifier, and so there are no objects that we can denote with a nominal expression and posit as the objects of searches. In fact, this is true for all of (7-a)-(10-a); there are simply no nominal expressions that we can substitute for the complements of the verbs that allow them to keep their original readings.

What these arguments show is that attempting to solve the generalized puzzle by finding the appropriate kind of object for each attitude is a lost cause. When we consider the full range of grammatical categories for which the substitution puzzle arises, we see that *any* substitution of a nominal expression for a non-nominal one will force an unintended reading, and result in a category mistake. In turn, this shows that there are readings of certain constructions—such as the notional reading of a sentence involving an intensional transitive verb—that are only available when the verb takes a non-nominal complement. Such readings are *essentially non-nominal*.

5. A More Promising Approach

What is the solution to the generalized, strengthened puzzle? Here I will argue that the only view that has the tools to solve the generalized puzzle is the view developed by Forbes [2018], who claims that substitution of a noun phrase for a co-referring clause changes the *thematic role* played by the argument. On this view, Prior's puzzle is the result of a shift in the argument structure of the verb that results from a change in the syntax of its complement.

Returning to our original example, on Forbes' view, (1-a) has the logical form in (24-b), while (1-b) has the logical form in (25-b):

- (24) a. Sally fears that Fido bites
 b. $\exists e[\text{fear}(e) \ \& \ \text{in}(e, \text{Sally}) \ \& \ \text{content}(e, \text{that Fido bites})]$
- (25) a. Sally fears the proposition that Fido bites
 b. $\exists e[\text{fear}(e) \ \& \ \text{in}(e, \text{Sally}) \ \& \ \text{theme}(e, \text{the proposition that Fido bites})]$

In (24), Sally is in a state of fearing, and “that fido bites” refers to a proposition that serves as the *content* of that state. By contrast, in (25), Sally is in a state of fearing, and “the proposition that Fido bites” refers to a proposition that serves as the *theme* of that state—i.e. the state’s direct object. Thus, Forbes’ view preserves the view that both *that*-clauses and their corresponding descriptions refer to propositions, but takes the syntactic difference between phrasal and clausal complements to occasion a change in the verbal denotation.

Forbes’ proposal solves the quantificational and pronominal puzzles. The reason that nominal quantification into the complement of a PA verb is invalid on Forbes’ view is that treating the quantifier as a nominal forces a reading on which the instance of the quantifier serves as the theme of the state. This explanation pairs with the explanation of why substitution of a nominal expression for the *that*-clause is invalid: it is invalid because such a substitution shifts the thematic role played by the argument. But on the other hand, Forbes’ view has an explanation of the validity of the quantificational inference: it is quantification over the proposition that plays the content role. Further, Forbes’ proposal stands to generalize beyond the propositional case. Forbes [2006] provides a semantics for intensional transitive verbs that accounts for the difference between (7-a) and (7-b), and the same strategy can be employed to account for all of (7)-(10).

Forbes’ proposal is in many ways similar to King’s. Both hold that Prior’s puzzle results from an ambiguity between transitive and clausal readings of the verb, and an equivocation between these two readings occasioned by the syntactic features of the verb’s argument. However, Forbes’ proposal has two advantages over King’s. First, Nebel [Forthcoming] provides arguments against King’s [2002] solution to the substitution puzzle. According to Nebel, a view on which attitude verbs have different meanings when they take clausal and phrasal complements entails that coordinating clausal and phrasal arguments gives rise to zeugma. But, he argues, clausal and phrasal complements do not give rise to zeugma, and so such attitude verbs do not appear to be standardly ambiguous. However, in contrast to King’s view, Forbes’ view predicts the absence of zeugma. Forbes’ view predicts that differences between clausal and phrasal complements lead only to a change in the thematic role played by the propositional argument, but not in the main predicate expressed by the verb. (24-b) and (25-b) differ only in the role they assign to the internal argument, but both denote the same kind

of state: fear.

Further, by allowing one and the same object—a proposition—to play two different roles in the argument-structure of the verb, Forbes' view allows us to keep the semantics of the existential quantifier fully nominal. On Forbes' view, (26-a) is ambiguous between (26-b) and (26-c):

- (26) a. Sally fears something
 b. $\exists p \exists s [\text{fear}(s) \ \& \ \text{in}(s, \text{Sally}) \ \& \ \text{content}(s, p)]$
 c. $\exists p \exists s [\text{fear}(s) \ \& \ \text{in}(s, \text{Sally}) \ \& \ \text{theme}(s, p)]$

But both (26-b) and (26-c) involve fully nominal quantification. The key feature of Forbes' view that allows him to avoid the need for non-nominal quantification is the extra degree of freedom that thematic roles afford the propositional argument.⁸

By contrast, King's view does not allow quantification to remain univocal and fully nominal. On King's proposal, the logical forms of (24-a) and (25-a) are given by (27) and (28), respectively:

- (27) $\text{fear}_{tc}(\text{Sally}, \text{that Fido bites})$
 (28) $\text{fears}_{pd}(\text{Sally}, \text{the proposition that Fido bites})$

In (27) and (28), fear_{tc} and fear_{pc} are different relations—the first is expressed by “fear” when it is complemented by a *that*-clause, and the other is expressed by “fear” when it is complemented by a propositional description. But on King's view, both the *that*-clause and its corresponding description designate the same thing: a proposition, and so contribute the same object to logical form. (29) and (30) then follow from (27) and (28), respectively:

- (29) $\text{Fears}_{tc}(\text{Sally}, \text{something})$
 (30) $\text{Fears}_{pd}(\text{Sally}, \text{something})$

But when we treat the quantifier with the standard nominal semantics, as in (31), it this again forces the transitive, direct object reading:

⁸This is what I meant when I said, above, that one can solve the puzzle by finding a way to make quantifications like the one in (3) nominal after all.

(31) $\exists p \in D_p$ such that Fears(Sally,p)

Providing a nominal semantics for the quantifier forces the relation expressed by the attitude verb to be the one expressed when it takes a propositional description as its complement. This entails that nominal existential generalization over *that*-clauses in the complements of propositional attitude verbs such as “fear” is invalid. Thus, King’s view, unlike Forbes’ view, requires supplementation with a theory of non-nominal quantification.

6. Conclusion

The arguments above show that, whatever one thinks of thematic roles, Forbes’ proposal, which employs them essentially, appears to have the resources to solve the generalized form of Prior’s puzzle, while the proposals due to Parsons, King, Moffett, Harman, and Nebel do not. Forbes’ proposal avoids positing ambiguities in the kinds of states expressed by attitude verbs, and also preserves the standard semantic approach to existential quantification—two considerable theoretical virtues. Together, these considerations appear to count in favor of adopting Forbes’ neo-Davidsonian approach to the semantics of verbs for which Prior’s puzzle arises. While a proposal such as King’s may—if significantly extended and supplemented—have the generality to solve the puzzle, the proposal faces significant objections, and the work needed to make the view viable has yet to be done.⁹

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⁹Rosefeldt [2008] takes up the challenge of supplementing King’s view with a non-nominal semantics for quantifiers such as “something”. In my manuscript “Non-Nominal Quantification as Answer Quantification”, I criticize Rosefeldt’s proposal, and provide a new theory of non-nominal quantification that, I claim, can also serve as an interpretation of quantification in higher-order logic. On my view, non-nominal quantifiers range over *answers to questions*.

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