

RAMSIFICATION AND THE RAMIFICATIONS OF PRIOR'S PUZZLE

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Ramsification is a well-known method of defining theoretical terms that figures centrally in a wide range of debates in metaphysics. 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 sometimes fails to preserve truth, and other times fails to preserve grammaticality. On the surface, Ramsification and Prior's puzzle appear to have little to do with each other. But Prior's puzzle is much more general than is ordinarily appreciated, and Ramsification requires a solution to the generalized form of Prior's puzzle. Without such a solution, a wide range of theories will either fail to imply their Ramsey sentences, or have Ramsey sentences that are ill-formed. As a consequence, definitions of theoretical terms given using the Ramsey sentence will be either incorrect or nonsensical. I present a partial solution to the puzzle that requires making use of a neo-Davidsonian language for scientific theorizing, but the would-be Ramsifier still faces serious challenges.

1. Introduction

Ramsification is a method of defining theoretical terms that is of central importance to a range of debates in the philosophy of science, the philosophy of mind, metaphysics, ethics, and philosophical methodology. The method begins, following Ramsey, by taking a theory's postulate and replacing its theoretical terms with existentially bound variables, which yields the theory's Ramsey sentence. The method continues, following Lewis, by using the Ramsey sentence—along with a bit of extra machinery—to provide explicit definitions of each theoretical term.¹ The underlying idea is that the Ramsey sentence specifies the role each

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¹What I am calling "Ramsification" is often called the "Ramsey-Lewis method of defining theoretical terms". In presenting the method, I will for the most part follow Lewis's [1970] presentation, which differs in certain important ways from Ramsey's original [1931] proposal, and from Carnap's [1956] proposal which incorporates it. However, my arguments will apply

term plays in the theory at large, and each term can be given a definition in terms of this role. Ramsification is the foundation for the Canberra plan, and it is also the canonical method of formulating functionalist theories of mind, and functionalist theories more generally. It is hard to overstate the method's importance.²

Prior's puzzle is a puzzle concerning substitution within the complements of propositional attitude verbs. On the standard semantics, propositional attitude verbs 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*. 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.

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. Further, in many other cases, we cannot even substitute such co-referring expressions *salva congruitate*. Consider (2):

- (2) a. Sally hopes that Fido is nice.
b. *Sally hopes the proposition that Fido is nice.

Again, the standard theory tells us that "that Fido is nice" refers to a proposition. It also seems clear that "the proposition that Fido is nice" refers to the very same proposition. But while (2-a) is true, (2-b) is ungrammatical.³

What does Ramsification have to do with Prior's puzzle? At first glance, the method and the puzzle appear to be totally unrelated. But Prior's puzzle is a much more general puzzle than is ordinarily appreciated, and with-

equally to these earlier methods and to Lewis's development of them.

²Lewis himself thought that we should Ramsify *every* theory, but he is perhaps most widely known for applying Ramsification to the metaphysics of mind, and using functional definitions of mental terms to argue for the identity theory [see Lewis, 1972, 1988b, 2009]. But Ramsification has been applied to a wide range of other topics in metaphysics, including to causation [Menzies, 1996, Tooley, 1987] and normativity [Jackson and Pettit, 1995, Jackson, 1998, Colyvan, 2009]. For a discussion of the role that Ramsification plays in the Canberra plan, as well as a range of papers that employ it, see Braddon-Mitchell and Nola [2009].

³Nebel [Forthcoming] calls the puzzle concerning substitution *salva veritate* "Prior's Puzzle", and calls the puzzle concerning substitution *salva congruitate* "Rundle's puzzle". For simplicity, I use "Prior's puzzle" to subsume both, although I acknowledge that Rundle [1967] was the first to observe the grammatical puzzle.

out a solution to the generalized form of Prior's puzzle, Ramsification fails as a method of defining theoretical terms. Most importantly, Prior's puzzle has a quantificational variant that arises in the complements of *all* kinds of attitude (and indeed other) verbs, in adjectival positions, in adverbial positions, and in a range of other non-nominal grammatical positions. The quantificational puzzle is that if we give a nominal semantics for existential quantifiers occurring in such positions—i.e. if we spell out their semantics using first-order quantification in the metalanguage—it either renders existential generalization into these positions invalid, or renders the results ungrammatical.

Given that Ramsification depends essentially on replacing theoretical terms with existentially quantified variables, the generalized puzzle shows that a wide range theories either fail to entail their Ramsey sentences, or have Ramsey sentences that are ill-formed. As a consequence, the Carnap sentences for such theories, which serve to interpret the theoretical terms of those theories, will either be false or ill-formed. In the former case, Lewis's explicit definitions of theoretical terms will be incorrect, while in the latter case they will be nonsense. Thus, without a solution to the quantified form of Prior's puzzle, Ramsification is doomed. While it is unclear whether there is a complete solution to the generalized form of Prior's puzzle, I present a solution to some of the core instances of Prior's puzzle that involves adopting a neo-Davidsonian semantic theory. I then argue that any complete solution to the puzzle, and so any vindication of Ramsification, must incorporate these neo-Davidsonian elements.

The remainder of the paper proceeds as follows. In §2, I describe the method of Ramsification in more detail. In §3, I discuss Prior's puzzle and its quantificational variant, and show how both versions arise in a much wider range of positions than is ordinarily appreciated. In §4, I show how the quantificational puzzle undermines Ramsification. In §5, I evaluate four general routes for saving Ramsification, and in §6 I show that the only approach that has a hope of saving Ramsification requires doing our scientific and metaphysical theorizing in a neo-Davidsonian language that involves events and thematic roles. §7 is a brief summary and conclusion.

2. Ramsification

Ramsification is a method of defining theoretical terms using only vocabulary that is already understood.⁴ Often, Ramsification is glossed as a method of giv-

⁴Strictly speaking, one could Ramsify a theory, and so provide definitions of its theoretical terms, without *understanding* the theory's other vocabulary. Ramsification is just a method for coming up with definitions—whether those definitions help us understand the theoretical terms is another matter. However, the usual assumption—made by Lewis and many others—is that the non-theoretical vocabulary is already understood, and I will likewise make that assumption

ing a theoretical term's meaning in terms of its "place" or "location" in the theory at large—that is, in terms of how what the term denotes—if anything—is related to the denotations of the other T - and O -terms in the theory. But perhaps the best way of showing what Ramsification does is to understand how it works.

Lewis [1970] showed us how to Ramsify a theory in a few easy steps. Given a theory T , we begin by separating the vocabulary of the theory into two categories: the T -terms—or theoretical terms—which we are aiming to define, and the O -terms—the other terms—which are already understood. We then form the postulate of the theory:

$$\top[\tau_1 \dots \tau_n],$$

which is a single sentence from which all of the theory's theorems follow, here written to exhibit the occurrences of the T -terms, $\tau_1 \dots \tau_n$.⁵ We then replace each of the T -terms in the postulate by a variable, which yields what Lewis calls the *realization formula* of the theory:

$$\top[x_1 \dots x_n].^6$$

Each n -tuple that satisfies this open formula—in the sense familiar from Tarski—is said to *realize* the theory. We then existentially generalize each variable in the realization formula, which yields the *Ramsey sentence*:

$$\exists x_1 \dots x_n \top[x_1 \dots x_n].$$

The Ramsey sentence is true if and only if the theory is realized.

On its own, the Ramsey sentence does nothing to help define the T -terms, for they do not occur in it. However, from the Ramsey sentence and the postulate we can form the *Carnap sentence*:

$$\exists x_1 \dots x_n \top[x_1 \dots x_n] \supset \top[\tau_1 \dots \tau_n].$$

here.

⁵What does Lewis mean by "theory"? There are three options. (i) Any set of sentences. (ii) Any set of sentences closed under logical consequence (for some appropriate consequence relation—like the consequence relation of classical first-order logic). (iii) A particular axiomatization of a theory in sense (ii), i.e. a set of sentences from which all theorems of the theory follow as logical consequences, given an appropriate relation of logical consequence. I suspect that in "How to Define Theoretical Terms", Lewis has (iii) in mind, and envisions the postulate of T as the conjunction of the axioms of T . However, when Lewis [1972] applies the method to folk psychology, the postulate is the conjunction of the platitudes of folk psychology. Whether or not the platitudes serve as an axiomatization of folk psychology is unclear. Nothing in my arguments turns on whether the postulate is a conjunction of the axioms of a theory, so long as all of the theory's theorems are its consequences, given some appropriate consequence relation.

⁶In Lewis's formulation, we replace each of the T -terms with first-order variables. In Ramsey's formulation, we replace the T -terms with higher-order variables. But as we will see below, nothing turns on whether we replace T -terms with first-order or higher-order variables. My arguments apply to variables of all types.

The Carnap sentence says that if the theory is realized, then the T -terms name one of its realizations. Since the Carnap sentence is a meaning postulate, it places constraints on the denotations of the T -terms; the T -terms denote whatever they must in order to ensure its truth. However, since the truth of the Ramsey sentence does not require that the theory be uniquely realized, the truth of the Carnap sentence does not require that the T -terms uniquely denote. Thus the Carnap sentence provides a partial, but not a full interpretation of the theory's T -terms.⁷

Lewis, however—*contra* Carnap—holds that in the case where a theory is multiply realized, the T -terms of that theory should be denotationless, and the postulate should be treated as false.⁸ On his view, theoretical terms have denotations only if the theory is uniquely realized, and so he holds that partial interpretations of the sort given by the Carnap sentence are not adequate definitions of theoretical terms. Accordingly, Lewis modifies the Ramsey sentence to say that the theory is uniquely realized, which yields the *unique realization sentence*:

$$\exists y_1 \dots y_n \forall x_1 \dots x_n (\top [x_1 \dots x_n] \leftrightarrow (y_1 = x_1 \& \dots \& y_n = x_n)).$$

He then modifies the Carnap sentence to say that if the theory is uniquely realized, then the T -terms name the components of that unique realization:

$$\exists y_1 \dots y_n \forall x_1 \dots x_n (\top [x_1 \dots x_n] \leftrightarrow (y_1 = x_1 \& \dots \& y_n = x_n)) \supset \top [\tau_1 \dots \tau_n].$$

Together with two other meaning postulates stipulating that if the theory is not uniquely realized, the T -terms do not denote, the modified Carnap sentence uniquely specifies the denotations of the T -terms.⁹ Given this unique specifi-

⁷The Carnap sentence is sometimes said to “implicitly define” a theory's theoretical terms. If by “implicitly define” we mean that the Carnap sentence merely constrains the interpretation of T -terms, without fixing their denotations uniquely, then it is uncontroversial that the Carnap sentence implicitly defines the T -terms. But if implicit definitions are to meet the standard criteria of being conservative and eliminable, then the Carnap sentence cannot be said to implicitly define the theoretical terms, because the criteria of conservativity and eliminability require uniqueness (as a consequence of Beth's definability theorem). The idea that definitions should be conservative and eliminable is presumably why Lewis modifies the Carnap sentence in the way that he does.

⁸Lewis [1988a] later relaxed this condition—he allowed that if a functional description is only imperfectly realized, that we should allow a theoretical term to denote imperfectly: we should allow the T -term to denote something “close enough”. But if there is nothing close, then the term will be empty and the theory false. However, the question of uniqueness does not bear on my argument; as we will see, everything I say here holds for both the Ramsey and Carnap sentences and Lewis's modified versions that require unique realization.

⁹Lewis's three meaning postulates together provide an implicit definition—in the strong sense noted above—of the theory's T -terms: the T -terms have the same denotation in any model of the theory with the same domain that provides the same interpretation of the primitive expressions. Lewis also argues that these meaning postulates uniquely specify the *senses* of the T -terms: the meaning postulates uniquely fix the denotations of the T -terms at any possible world.

cation, Lewis then provides explicit definitions of the T -terms in terms of the unique realization sentence:

$$\tau_n = \neg y_n \exists y_1 \dots y_{n-1} \forall x_1 \dots x_n (\top [x_1 \dots x_n] \leftrightarrow (y_1 = x_1 \& \dots \& y_n = x_n))^{10}$$

This sentence defines t_n as the n th component of the unique realization of T , if there is one; if there isn't, t_n does not denote.

3. Prior's Puzzle Generalized

As we saw above, 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:

(3) Sally fears that Fido bites.

Suppose that the *that*-clause in (3) refers to a proposition. We can then existentially generalize into that position; (4) follows from (3):

(4) Sally fears something.

But now consider the standard semantics for the existential quantifier in type theory:

(5) $\llbracket \exists u_t \phi \rrbracket^{M, g} = 1$ iff there is some $a \in D_t$ such that $\llbracket \phi \rrbracket^{M, g^a_{u_t}} = 1$

In (5), u_t is a variable over the type t , and $\llbracket \phi \rrbracket^{M, g^a_{u_t}}$ 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”—i.e. the type of propositions—the clause yields that (4) is true iff:

(6) There is some $a \in D_p$ such that Sally fears a .

But clearly, (6) can be false even when (3) 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 (3) to (4) turns out to be invalid. Moreover, this invalidity arises even when we make use of higher-order variables; in the clause above, u_t can be a variable of any type. The problem

¹⁰Given that Lewis's three postulates provide implicit definitions for the T -terms of T , Beth's definability theorem guarantees that such explicit definitions are provable from the axioms of T (provided that T is a first-order theory, which Lewis is assuming). See Beth [1953], Boolos et al. [2007], and Gupta [2019] for discussion.

arises for any semantic clause that treats quantifiers like the one in (4) as nominal quantifiers—i.e. that specifies their semantics in the metalanguage using first-order quantification over sets.¹¹

The invalidity of this quantificational inference has the same source as the failure of the substitution in (1) to preserve truth; 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.

Moreover, the failure of nominal substitution and quantification to preserve truth is not specific to *that*-clauses or propositional attitude verbs. Rather, we observe such failures in a wide variety of other grammatical 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.¹²
- (9) a. Sally became wise.
b. Sally became the property of being wise.¹³
- (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.¹⁴ But substitution of a description of this semantic value in

¹¹The semantics of higher-order quantification is standardly spelled out in the metalanguage as many-sorted first-order quantification. In this case, quantification over the complement of “fears” is spelled out as first-order quantification over a particular subset of the domain: D_p , the set of propositions.

¹²This 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”.

¹³Friederike Moltmann [2003, 2004] uses this example to illustrate what she calls the *objectivization effect*. All of the examples of substitutions that fail to preserve truth here are instances of the objectivization effect.

¹⁴This 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:

(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 properties.¹⁵

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, together with standard type assignments, 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

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

The substitution in (11) does not preserve truth, despite the fact that the definite description denotes exactly what the indefinite denotes.

¹⁵Of 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. See Potts [1979] and Forbes [2018] for discussion of this point. Further, the puzzle would arise for whatever relation "carefully" bears to its semantic value. For example, we could just as easily formulate the puzzle using "has semantic value", "denotes", or any number of other locutions.

each of the generalizations in (12)-(15) is 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—forces a shift in the meaning of the verb from a clausal, intransitive reading to a transitive one.

But nominal substitution and quantification do not just lead to false conclusions—they often lead to ungrammaticality. Consider again our second example from the introduction:

(20) Sally hopes that Fido is nice.

Again, supposing that the *that*-clause in (20) refers to a proposition, we can generalize over that proposition; (21) follows from (20):

(21) $*\exists x_p(\text{Sally hopes } x_p)$,

where x_p is a nominal variable ranging over the set of propositions. But (21) is not well-formed; Sally does not, and cannot, hope a proposition.¹⁶ Further, reformulating (21) using a pronoun, the natural language analog of a nominal variable, again yields ungrammaticality:

(22) *There is a proposition such that Sally hopes it.

Finally, applying the semantics in (5) to (20) yields an ungrammatical ascription of truth-conditions in the metalanguage:

(23) *There is some $a \in D_p$ such that Sally hopes a .

Thus, like nominal substitution, nominal quantification into the complements of propositional attitude verbs sometimes leads to ungrammaticality.

But as before, this result is not limited to the case of propositional attitude verbs. Rather, nominal substitution and quantification lead to ungrammaticality across a range of positions. Consider the following examples:

(24) a. John wonders who came to the party.
b. *John wonders the question who came to the party.

(25) a. Mary is sleeping soundly.
b. *Mary is sleeping the property of events denoted by “soundly”

(26) a. Johnny seeks something flammable.

¹⁶Strictly speaking, since (21), with its explicit use of typed variables, is already out of the running as a candidate grammatical sentence of English, in saying that it is not well-formed what is meant is that even in the natural extension of English accommodating such formal devices, (21) would be ungrammatical (by contrast, say, with the result of putting “denies” for “hopes” in (21).)

- b. *Johnny seeks something the property of being flammable.

In each case, while the original sentence is perfectly grammatical, substituting a nominal expression reduces the original to ungrammaticality. Further, nominal quantifications into these positions again yields ill-formed results; consider (24)-(26):

- (27) a. John wonders who came to the party.
 b. $*\exists x_{\langle\langle s,t \rangle, t \rangle}(\text{John wonders } x_{\langle\langle s,t \rangle, t \rangle})$.
 c. *There is a question such that John wonders it.
- (28) a. Mary is sleeping soundly.
 b. $*\exists x_{\langle\langle e,t \rangle, \langle e,t \rangle \rangle}(\text{Mary is sleeping } x_{\langle\langle e,t \rangle, \langle e,t \rangle \rangle})$.
 c. *There is a way such that Mary sleeps it.
- (29) a. Johnny seeks something flammable.
 b. $*\exists x_{\langle e,t \rangle}(\text{Johnny seeks something } x_{\langle e,t \rangle})$.
 c. *There is a property such that John seeks something it.

Each of (27-b)-(29-b) is the result of replacing “who came to the party”, “soundly”, and “flammable” by variables of the appropriate type and binding them with an existential quantifier. But if the semantics of these quantifiers are given by (5), then the variables in (27-b)-(29-b) will be nominal variables, and as a consequence, each of (27-b)-(29-b) will be ill-formed. (27-c)-(29-c) are the English analogs of (27-b)-(29-b) involving pronouns, each of which is ungrammatical.

The substitutional and quantificational forms of the puzzle are intimately related. If nominal quantification into a position preserves truth or grammaticality, then substitution of singular terms—including names and definite descriptions—will likewise preserve truth or grammaticality, because these singular terms serve as witnesses for nominal existential quantifiers.¹⁷ Conversely, if substituting nominal expressions in a particular position preserves truth or grammaticality, then nominal existential quantification—henceforth just “nominal quantification”—into that position will likewise preserve truth or grammaticality, because those nominal expressions will be the expressions replaced by nominally quantified variables. Thus, the substitutional and quantificational puzzles go hand in hand.

The result is that Prior’s puzzle can be generalized along two dimensions. First, the substitutional form of the puzzle is accompanied by a quantificational puzzle, which likewise yields both invalidity and ungrammaticality. Second, both the substitutional and quantificational puzzles arise in a wide range of non-nominal grammatical positions; we saw some examples of such positions above, and will encounter further examples presently.

¹⁷By “witness” I here mean an expression that, when substituted for the existential quantifier, yields a true substitution instance of the quantified sentence.

4. Quantificational Prior's Puzzle undermines Ramsification

4.1. The Problem, Illustrated

In order to see the problem that the generalized form of Prior's puzzle poses for Ramsification, suppose that our theory has a postulate consisting of one sentence: "Sally feels emotional", and for the moment, suppose that "emotional" is its sole *T*-term.¹⁸ In that case, the Ramsey sentence for the theory is:

$$(30) \quad \exists x_t(\text{Sally feels } x_t).^{19}$$

The problem is that our theory does not entail its Ramsey sentence. The standard semantics for the existential quantifier yields that (30) is true iff

$$(31) \quad \text{There is some } a \in D_t \text{ such that Sally feels } a.$$

But clearly, (31) can be false even while "Sally feels emotional" is true; replacing "emotional" with a nominal variable and binding the variable with an existential quantifier changes the meaning of the verb "feels".²⁰ In (31) "feels" is a transitive verb, whereas in "Sally feels emotional", "feels" is not—depending on one's preferred semantics, it is either intransitive or copular. As a consequence, the Ramsey sentence in (31) is the Ramsey sentence of the *wrong theory*, and does not even provide a correct *partial* interpretation of the theory's *T*-term.

Now consider the Carnap sentence for the theory:

$$(32) \quad \exists x_t (\text{Sally feels } x_t) \supset \text{Sally feels emotional}.$$

In (32), the main verb used in the antecedent of the conditional has a different argument structure from the one used in the consequent—one is transitive and

¹⁸Here I am simplifying in two ways. First, the candidates for Ramsification that Lewis had in mind were clearly highly complex theories containing many different interconnected terms. I make use of a very simple postulate simply for purposes of illustration; the problem arises just as readily for complex theories. Second, the sentences for which Prior's puzzle arises do not need to be conjuncts in the postulate. Rather, if the problem arises for any sentence in our theory—that is, any sentence entailed by the postulate—then the postulate will not entail its Ramsey sentence, because the Ramsey sentence will have consequences that the postulate does not.

¹⁹While in Lewis's presentation of Ramsification, he makes use of only first-order variables, other presentations, such as Ramsey's own, make use of higher-order variables. Here I provide the variable *x* with a schematic type assignment *t* to emphasize that the quantificational version of Prior's puzzle arises no matter what type of variables we use, so long as we provide the quantifiers that bind those variables with a nominal semantics. Further, keeping the type assignment schematic allows me to remain neutral on exactly how to type the expressions that such variables replace—different compositional semantic theories disagree about how to type these expressions.

²⁰I discuss the possibility of providing the quantifier with non-nominal semantics in §5.3.

one is not. This shows that (32) can be false: supposing that “emotional” denotes a property, Sally can feel a property without feeling emotional. Ordinarily, the Carnap sentence is taken to be *analytic*, because it serves as a meaning postulate that partially interprets the theory’s *T*-terms. But that fact that it is not only not analytic, but plausibly false, shows that it provides the wrong interpretation for the theory’s *T*-term, “emotional”.

The same problem arises for Lewis’s modified Ramsey and Carnap sentences, and his explicit definition of theoretical terms given in terms of them. The unique realization sentence for this theory,

$$\exists y_1 \dots y_n \forall x_1 \dots x_n (\top [x_1 \dots x_n] \leftrightarrow (y_1 = x_1 \& \dots \& y_n = x_n)),$$

says that the theory is uniquely realized. But the problem is that this sentence is not a consequence of the postulate, even if we assume that the *T*-terms, $\tau_1 \dots \tau_n$ are non-empty. For in removing these terms from the postulate and replacing them with nominally quantified variables, we change the meanings of the other expressions in the postulate so that the modified Ramsey sentence is no longer its consequence—it is the unique realization sentence of the wrong theory. Further, the same argument as above shows that the Carnap sentence for the theory, modified in order to claim that the *T*-terms denote only if the theory is uniquely realized, is not only not analytic, but plausibly false, and so is not suitable to interpret the theory’s *T*-term. Finally, consider Lewis’s explicit definition of *T*-terms:

$$\tau_n = \imath y_n \exists y_1 \dots y_{n-1} \forall x_1 \dots x_n (\top [x_1 \dots x_n] \leftrightarrow (y_1 = x_1 \& \dots \& y_n = x_n))$$

In the case of our toy theory, this allows us to define “emotional” as follows:

$$(33) \quad \text{emotional} = \imath y_1 \forall x_1 (\text{Sally feels } x_1) \leftrightarrow (y_1 = x_1).$$

The problem is that this definition forces “felt” to have its transitive reading, and so defines the property of being emotional as the unique thing felt—clearly the wrong definition.

It is important that this problem does not just show that Ramsification yields the wrong definitions for terms in non-nominal verbal complements, although it does do that. Rather, it yields the wrong meaning for the verbs themselves: it forces the verb to take on a transitive reading. To see this, suppose that we not only treat “emotional” as a *T*-term, but also treat “feels” as a *T*-term. In that case, we would define “feel” as follows:

$$(34) \quad \text{feels} = \imath y_1 \exists y_2 \forall x_1, x_2 ((\text{Sally } x_1 x_2) \leftrightarrow (y_1 = x_1 \& y_2 = x_2)).$$

In this case, treating both “emotional” and “feels” as names forces “feels” to take on its transitive reading, and so yields the definition that “feeling” is the unique

relation that Sally bears to a property—the property of being emotional.²¹ This is clearly the wrong definition—in our definition, “feels” has the wrong argument structure: it is a binary relation between a person and a property. Thus, Ramsification not only yields the wrong definition of *T*-terms in verbs with non-nominal complements, it also yields the wrong definitions of the verbs themselves.

Now we turn to the case of ungrammaticality. Suppose that we have a theory whose sole sentence is (35):

(35) Bill resembles a stockbroker,

and that “stockbroker” is the theory’s sole *T*-term. Suppose further that we are considering this sentence on its notional reading: we are considering the case where Bill resembles a stockbroker, but not a particular one. In this case, the Ramsey sentence for our theory is (36):

(36) $\exists x_t(\text{Bill resembles a } x_t)$.

But if (36) involves nominal quantification, then (36) is ungrammatical. Making use of a nominal semantics for the quantifier assimilates the position in which x_t occurs to a position in which a name can occur. But treating the position this way yields nonsense, as we can see if we substitute names for the bound variable in (35):

- (37) a. *Bill resembles a the property of being a stockbroker.
b. *Bill resembles a Bob.

Both of these sentences are ungrammatical, and they bring out the absurdity of treating the quantifier in (36) with the standard semantics. But if the Ramsey sentence for our theory is ungrammatical, so too is its Carnap sentence:

(38) $\exists x_t(\text{Bill resembles a } x_t) \supset \text{Bill resembles a stockbroker}$.

The same holds for both the unique realization sentence and the Lewis’s modified Carnap sentence: nominal quantification renders both ungrammatical.

Two ways of avoiding such absurdity immediately come to mind. First, we might try reformulating (36) as in (39):

(39) $\exists x_e(\text{Bill resembles } x_e \ \& \ x_e \text{ is a stockbroker})$.

²¹Here I use “bears to” as a semantically neutral re-parsing device allowing us to trade in an adjectival formulation for a nominal formulation and make the definition grammatical. As we will see, Lewis claims that if simply have the right copular verbs among our *O*-terms, we can accommodate nominalization. But given that “bears to” is not a copular verb, this example shows that we need more than just copular verbs among our *O*-terms to maintain grammaticality while nominalizing the adjectival complements of verbs such as “feels”. Lewis drastically underestimates the resources required for nominalization.

But this is clearly not a good paraphrase of (35)—(39) requires there to be a particular, existent stockbroker whom Bill resembles, while, as we said above, the notional reading of *d* does not require either. This is a general fact about the complements of intensional transitive verbs such as “resembles”: one cannot treat quantified noun phrases in their complements, such as “a stockbroker”; as wide-scope quantifiers—such quantifiers cannot be “raised”.²² Alternatively, instead of quantifying over one word in the complement—“stockbroker”—we might try quantifying over the entire NP complement “a stockbroker”. Consider (40):

- (40) a. Bill resembles a stockbroker.
 b. Bill resembles something.
 c. $\exists x_t(\text{Bill resembles } x_t)$.

(40-b) follows from (40-a)—from the fact that Bill resembles a stockbroker, it follows that Bill resembles something. But “something” here replaces the entire noun phrase “a stockbroker”, rather than just the expression “stockbroker”. Letting such existential generalizations be our guide, we can treat “a stockbroker” as a complex name for a generalized quantifier (or a property, depending on one’s preferred semantics for intensional transitives), and treat “something” as a nominal quantifier over generalized quantifiers, as in (40-c). This strategy allows us to avoid ungrammaticality, because it allows us to avoid nominally quantifying into an adjectival position.

But there are two reasons that this strategy will not help us. First, Lewis’s method is supposed to be a totally general method—in principle, any term can be a *T*-term. But if, in order to preserve interpretability, we have to replace phrases including those terms with existentially quantified variables, rather than the terms themselves, there is no guarantee that the resulting definition will be correct. Second, and perhaps more importantly, this strategy simply takes us from an uninterpretable result to an invalidity. For suppose that “a stockbroker” denotes a generalized quantifier (or a property). It does not follow from the fact that Bill resembles a stockbroker that he resembles a generalized quantifier (property), which yields invalidity instead of ungrammaticality. Thus, this response is no response at all—it takes us from one form of quantificational Prior’s puzzle to another.

4.2. How General is the Problem?

One might worry, however, that the problems of invalidity and ungrammaticality are relatively isolated, or only occur occasionally at the fringes of our theories. But this is far from the case. Consider the following examples:

²²For an account of quantifier raising, see Heim and Kratzer [1998, Ch. 6].

- (41) a. Sally fears pain.
 b. $\exists x_{\langle e,t \rangle}$ (Sally fears $x_{\langle e,t \rangle}$).
 c. There is some $a \in D_{\langle e,t \rangle}$ such that Sally fears a .
- (42) a. Mary sounds depressed.
 b. $\exists x_{\langle e,t \rangle}$ (Mary sounds $x_{\langle e,t \rangle}$).
 c. There is some $a \in D_{\langle e,t \rangle}$ such that Mary sounds a .
- (43) a. The fumes smell poisonous.
 b. $\exists x_{\langle e,t \rangle}$ (the fumes smell $x_{\langle e,t \rangle}$).
 c. There is some $a \in D_{\langle e,t \rangle}$ such that the fumes smell a .
- (44) a. The spaghetti tastes delicious.
 b. $\exists x_{\langle e,t \rangle}$ (the spaghetti tastes $x_{\langle e,t \rangle}$).
 c. There is some $a \in D_{\langle e,t \rangle}$ such that the spaghetti tastes a .
- (45) a. John considers his friend Bill brilliant.
 b. $\exists x_{\langle e,t \rangle}$ (John considers his friend Bill $x_{\langle e,t \rangle}$).
 c. There is some $a \in D_{\langle e,t \rangle}$ such that Bill considers his friend a .
- (46) a. John reads the newspaper.
 b. $\exists x_{\langle e,t \rangle}$ (John reads $x_{\langle e,t \rangle}$).
 c. There is some $a \in D_{\langle e,t \rangle}$ such that John reads a .
- (47) a. John fears snakes.
 b. $\exists x_{\langle e,t \rangle}$ (John fears $x_{\langle e,t \rangle}$).
 c. There is some $a \in D_{\langle e,t \rangle}$ such that John fears a .
- (48) a. John became diabetic.
 b. $\exists x_{\langle e,t \rangle}$ (John became $x_{\langle e,t \rangle}$).
 c. There is some $a \in D_{\langle e,t \rangle}$ such that John became a .
- (49) a. The child learned rapidly.
 b. $\exists x_{\langle \langle e,t \rangle, \langle e,t \rangle \rangle}$ (the child learned $x_{\langle \langle e,t \rangle, \langle e,t \rangle \rangle}$).
 c. There is some $a \in D_{\langle \langle e,t \rangle, \langle e,t \rangle \rangle}$ such that the child learned a .
- (50) a. The asteroid changed course. Moltmann [2004]
 b. $\exists x_{\langle s,e \rangle}$ (the asteroid changed $x_{\langle s,e \rangle}$).
 c. There is some $a \in D_{\langle s,e \rangle}$ such that the asteroid changed a .

Suppose that we treat the following terms in (41-a)-(50-a) as T -terms: “pain”, “sad”, “depressed”, “poisonous”, “delicious”, “brilliant”, “the newspaper”, “snakes”, “diabetic”, and “course”. The Ramsifications of (41-a)-(50-a) are then given by (41-b)-(50-b), respectively. If we make use of the standard semantics for the existential quantifier given in (5), the truth-conditions of (41-b)-(50-b) are given by (41-c)-(50-c). But each of (41-c)-(50-c) can be false even while (41-a)-(50-a) are true. Thus, quantificational Prior's puzzle renders existential generalization over

the *T*-terms listed above invalid. As a consequence, any theory that includes one of these sentences, or a sentence like it, will not imply its Ramsey sentence.

Let us consider these invalidities more carefully. In (41), removing 'pain' and replacing it with a nominally quantified variable of the relevant type yields that Sally fears an abstract object: an element of the domain $D_{\langle e,t \rangle}$. This certainly seems wrong, and if it is, then (41-b) will not follow from (41-a). Similarly, if we replace "poisonous" with "the property of being poisonous", the result is obviously false: the fumes do not smell an abstract object. The same holds for "sound" and "taste"; in each case, nominalizing the adjectival complements yields a transitive reading for the verb, which has an altogether different, and in some cases absurd meaning. Much the same is true with (48): replacing 'diabetic' with an existentially bound variable yields forces "become" to take on its identity reading, as opposed to its predicative reading, and as a result, (48-b) does not follow from (48-a).

We observe the same phenomenon in adverbial positions. If we replace an adverb with a variable bound by a nominal existential quantifier, it can often force a change in the meaning of the verb, as it does in (49), in which 'learned' takes on a transitive reading. In (50), replacing 'course' with a nominally quantified variable yields an anomalous reading that does not follow from (50-a). These examples can be multiplied at will; they are not some small set of fringe examples. Rather, they involve a variety of common verbs, including psychological, perceptual, and copular verbs, and they make use of relatively ordinary grammatical constructions. This problem arises for any non-nominal verbal complement, along with a variety of other positions, including adverbial and adjectival positions.

But it is not just invalidity that is a very general phenomenon; nominal quantification also often leads to nonsensical results. Consider the following examples:

- (51) a. John needs something flammable.
 b. $*\exists x_{\langle e,t \rangle}(\text{John needs something } x_{\langle e,t \rangle})$.
 c. $\exists x_{\langle e,t \rangle}(\text{John needs } x_{\langle e,t \rangle})$.
- (52) a. The weather looks ominous.
 b. $*\exists x_{\langle e,t \rangle}(\text{the weather looks } x_{\langle e,t \rangle})$.
- (53) a. Maxwell seeks a perfect gas.
 b. $*\exists x_{\langle e,t \rangle}(\text{Maxwell seeks a } x_{\langle e,t \rangle})$.
 c. $\exists x_{\langle e,t \rangle}(\text{Maxwell seeks } x_{\langle e,t \rangle})$.
- (54) a. The program simulated a catastrophic selloff.
 b. $*\exists x_{\langle e,t \rangle}(\text{the program simulated a } x_{\langle e,t \rangle} \text{ selloff})$.
 c. $\exists x_{\langle e,t \rangle}(\text{the program simulated } x_{\langle e,t \rangle})$.

- (55) a. Mary imagined a frictionless plane.
 b. $*\exists x_{\langle e,t \rangle}(\text{Mary imagined a } x_{\langle e,t \rangle})$.
 c. $\exists x_{\langle e,t \rangle}(\text{Mary imagined } x_{\langle e,t \rangle})$.

Suppose that in this case, the *T*-terms that we wish to define in (51-a)-(55-a) are “flammable”, “ominous”, “perfect”, “catastrophic”, and “frictionless”, respectively. In each case, nominal quantification yields ungrammaticality. In (51), replacing ‘flammable’ with a nominally quantified variable yields nonsense: neither the syntax of English nor of any formal language allows a name to immediately follow a quantificational expression like ‘something’. Similar claims hold for (52)-(55). In each case, if we wish to define a term that occurs as a component of a complex NP in an intensional position, we cannot, because we cannot replace such expressions with nominal ones *salva congruitate*.

Again, as above, we might try to avoid this ungrammaticality by either raising the quantifier, or by treating it as replacing the entire noun phrase in object position, as in (51-c)-(55-c). But for the same reasons as above, neither of these options suffices. One option is clearly not equivalent to the intended, notional readings of (51-a)-(55-a). The other option, illustrated in (51-c) and (53-c)-(55-c), leaves us with invalidity instead of ungrammaticality. Thus, like the quantificational and substitutional puzzles, nominal quantification leads to ungrammaticality in a wide range of relatively ordinary cases.

5. Responses

There are at least four ways of responding to the threat that Prior's puzzle poses to Ramsification. Here I discuss the responses from least to most plausible.

5.1. Response 1: Exclusion

The first response is to simply ban expressions for which these puzzles arise from the theories that we intend to Ramsify. We could, for instance, exclude intensional transitive verbs, adverbs, adjunct predicates, perceptual verbs with adjectival complements, and copular verbs such as “become” from our theories. But this approach comes at an extremely high cost; restricting our vocabulary in this way deprives Ramsification of much of its appeal. This is particularly obvious in the case of psychological theories. Any adequate psychological theory will employ a wide range of intensional locutions—including verbs like “fears”, “hopes”, and “feels”. But if such verbs are excluded from our psychological theory on the grounds that they cannot be Ramsified, then Ramsification will surely not be suitable for Ramsifying genuine psychological theories.

Lewis himself, however, thought that we could formulate psychological theories with just two attitude verbs: “believes” and “desires”. If Lewis was correct

to think this, then many of the examples we have discussed can be legitimately excluded, or analyzed away in terms of the two propositional attitudes. But the idea that every psychological verb can be given some analysis in terms of “believes” and “desires” has been largely discarded, and with good reason. First, it seems unmotivated. Why should we think that every term in a psychological theory should be analyzed in these terms? And why would we undertake such a reduction? Second, it is widely accepted that intensional transitive verbs such as “seek”, “need”, and “imagine” do not have decompositions into complex propositional attitudes, and the states that they express are not metaphysically analyzable in propositional terms.²³ Third, even ignoring the clash between the propositional and non-propositional cases, it is extremely hard to see how to give analyses of states of imagination or perception in terms of beliefs and desires. A realistic psychological theory will need many more primitives than just “believes” and “desires”.

5.2. Response 2: Tolerance

The second response is to hold that Ramsification is perfectly safe as long as we allow for imperfect realization, and are tolerant of some small amount of falsehood. Imperfect realization would allow for some small amount of imprecision in our functional definitions. For instance, we might say that John has property *P* at 3:30pm on November the 17th, 2019, AEST. But surely this is too restrictive to figure in our definition—we should allow his having the property at 3:31pm to realize this sentence. But the problem is that the mistaken definitions yielded by Ramsification are not due to imprecision, and cannot be remedied by allowing for imperfect realization. Rather, they are glaringly, horribly false—they are often *category mistakes*. This is not the kind of problem with a definition that can be remedied by allowing for imperfect realization, or looking for a nearby realization, as Lewis suggests. Feeling a property is not a nearby realization of feeling sad. Further, imperfect realization does not account for ungrammaticality.

Second, we might, as Lewis [1972] suggests, Ramsify our theory of folk psychology by forming clusters of psychological claims: disjunctions of conjunctions of *most* of the platitudes of folk psychology. In this way, we can allow for some of the claims to be false, while still having one of the conjunctions in our disjunction be true, and so serve to define our term. However, this is to underestimate the scope of the problem. A huge number of our ordinary psychological and idioms are expressed by intensional verbs, and include expressions in non-nominal positions. Even if we formed our clusters to allow these claims to be false, it would yield a systematically skewed theory: we would effectively be excluding terms for which Prior’s puzzle arises from our theories.

²³See Forbes [2006] and Montague [2009] for arguments to this effect.

5.3. Response 3: Non-Nominal Resistance

As Lewis presents it, Ramsification involves replacing theoretical terms with first-order variables. This has often been contested; other presentations of Ramsification, including Ramsey's, make use of higher-order variables. But as we saw above, when it comes to providing a semantics for quantifiers that bind these variables, it makes no difference whether the variables are first- or higher-order. The quantificational puzzle arises from treating variables—of whatever order—as nominal variables, and with providing a semantics for quantifiers that bind them using first-order quantification in the metalanguage.

However, the third response to the problem presented by Prior's puzzle is to allow for genuinely non-nominal higher-order quantification. On this proposal, expressions of different semantic types—predicates, quantifiers, and various kinds of verbal complements—do not serve to name their semantic values, but rather have different semantic functions; predicates predicate, quantifiers quantify, *etc.* We then need a corresponding theory of non-nominal quantification—one that does not interpret such quantifiers as binding variables that range over subsets of the first-order domain. Developing such a theory would allow us to specify the semantics of quantificational expressions—and so to Ramsify—without encountering Prior's puzzle.

There are at least two approaches of this sort, one due to Rosefeldt [2008], and the other due to Williamson [2013]. Rosefeldt proposes that we modify the standard clause for the existential quantifier. In order to modify this clause, we first consider an interpretation I —a function from the expressions of our language into a model.²⁴ Rosefeldt then defines what he calls α_a -variant of an interpretation I . According to Rosefeldt, if α_a is a constant symbol of syntactic type a in a language L , then

- (56) an interpretation I^* is an α_a -variant of I iff I^* differs only in which element of D_a it assigns to α_a .

He then gives the truth-conditions for the existential quantifier as follows:

- (57) If ϕ is of the form $\lceil \exists \chi_a \psi \rceil$ then ϕ is true under I iff $\psi[\alpha_a/\chi_a]$ is true under at least one α_a -variant of I .

However, this proposal is not non-nominal, and ultimately occasions the same problems as the standard clause. To see this, we need to recognize that I is

²⁴Rosefeldt is not fully explicit about the behavior of I —he does not specify its domain and range. But I will assume that I performs roughly the same function as $\llbracket \cdot \rrbracket$ in standard compositional semantic theories, and that a sentence ϕ is true under I iff $I(\phi) = 1$, where 1 is one of two truth-values in the model.

a function, and is nominal in its output or value position.²⁵ Thus, I assigns a value to α_n from the appropriate domain by either naming such a value or by nominally quantifying over objects from that domain. But once we recognize this fact, we see that Rosefeldt's definition is equivalent to the standard clause above. In order to have a theory of non-nominal quantification, we would need an interpretation function that was non-nominal in its object position. So long as the interpretation function interprets the vocabulary of our theory by naming an expression and naming the piece of reality (or object in a model) that gets assigned to that expression, the resulting semantics will be a nominal semantics.

Williamson [2013, Ch. 5] recognizes this fact, and acknowledges that if we assimilate non-nominal quantification to nominal quantification, the resulting model-theoretic semantics will not provide the intended interpretation of our language—it will yield changes in meaning exactly like the ones occasioned by Prior's puzzle. Thus, he concedes that proposals such as Rosefeldt's are doomed—they try to spell out the interpretations of non-nominal expressions using a nominal interpretation function: one that interprets expressions of each different semantic category in a uniform way. This is the core problem with standard type-theoretic semantic theories: they treat *every* expression as a singular referring expression, and differentiate such expressions only by the type of thing that those expressions denote.

Williamson's own proposal is to provide a semantics for higher-order quantifiers in a language that is yet even higher-order. Thus, Williamson avoids reducing higher-order quantification to nominal quantification by relying on our prior understanding of an even higher-order language. In this language, we can then specify the semantics of higher-order quantifiers in a way that is fundamentally non-nominal.

As appealing as this proposal is, it will not save Ramsification. The reason is that once we accept that the semantics of higher-order quantification cannot be treated model-theoretically, we lose an essential element of Ramsification: realization. Realization, for Lewis, is simply first-order satisfaction of the realization formula by a sequence of objects (of any type); it is a relation that a sequence of things in the world bears to a theory. Realization is essential to Ramsification—Lewis defines a theoretical term τ_n from theory T as the n th component of the unique realization of T , if there is one. The problem is that there is no analogue of realization for Williamson; satisfaction is an essentially first-order notion, and accordingly, so is realization. Therefore, Williamson's essentially higher-order proposal cannot save Ramsification.

²⁵This point would also hold if I were a relation, in which case I would take names in its second argument place.

5.4. Response 4: Nominal Assimilation and Regimentation

The fourth, and most plausible response is to avoid Prior's puzzle by regimenting our theories in advance of Ramsifying them. This was, in fact, Lewis's own approach.²⁶ Lewis recognized that Ramsification requires us to treat every theoretical term as a name, and he claimed that with the proper modifications in other areas of our theory, we could do just that:

We may stipulate that our *T*-terms are names, not predicates or functors. No generality is lost, since names can purport to name entities of any kind: individuals, species, states, properties, substances, magnitudes, classes, relations, or what not. Instead of a *T*-predicate '*F*__', for instance, we can use '*__* has *F*-hood'; '*F*-hood' is a *T*-name purporting to name a property, and '*__* has *__*' is an *O*-predicate. It is automatic to reformulate all *T*-terms as names, under the safe assumption that our *O*-vocabulary provides the needed copulas:

'__ has the property __'
 '__ is in the state __ at time __'
 '__ has __ to degree __'

and the like. We will later replace the *T*-terms with bound variables; by making the *T*-terms grammatically uniform, we avoid the need to introduce variables of diverse types. [Lewis, 1970]

Here Lewis proposes a method of regimentation to accommodate the nominalization of *T*-terms.²⁷ First, we stipulate that all *T*-terms are names. We then make use of copular verbs from our *O*-vocabulary to recapture the meanings of the pre-nominalized sentences. Thus, "John is tall" becomes "John has the property of being tall". Here, "the property of being tall" is open to nominal quantification: $\exists x_{\langle e,t \rangle}$ such that John has *x*.

As far as simple subject-predicate sentences are concerned, Lewis's method works perfectly—regimentations of the sort he proposes allow us to avoid Prior's puzzle. However, Lewis drastically underestimates the range of problems that

²⁶In endorsing this approach, Lewis undertakes what Prior [1971, Ch. 3] called the program of Platonism: of finding paraphrases for ordinary sentences that convert every non-nominal expression to a name, but are equivalent to the originals. Prior himself thought that the program of Platonism was viable, although he endorsed the opposite position. However, as we will see, there are reasons to doubt that Prior and Lewis were right about Platonism's viability.

²⁷But as we saw above, it is a mistake to think that not regimenting in this way would simply require us to introduce higher-order variables. On the contrary, regimentation would be required even if we introduced higher-order variables, so long as we treat them as nominal variables, and provide a nominal semantics for quantifiers that bind them.

result from nominalization, and the ease of accommodating it in all but the simplest sentences. Lewis claims that it is a safe assumption that our *O*-vocabulary contains the needed copulas. But not only is this assumption not safe, it appears to be false.

First, consider (58):

(58) Mary sounds depressed.

How can we regiment this sentence to avoid the puzzle? It will not do to name the property denoted by “depressed”; Mary does not sound the property of being depressed. Nor can we say “Mary sounds to have the property of being depressed”. We might try “Mary sounds like she has the property of being depressed”. But it is unclear whether this captures the original meaning. Moreover, in this case the puzzle arises in a new form: “she has the property of being depressed” is a sentence, which presumably denotes either a proposition or a truth-value. But Mary does not sound like either a proposition or a truth-value. Similar arguments hold for (43), (44), and (45). In the case of (46), “the newspaper” is a weak definite: it does not denote a particular newspaper, but rather denotes a property or a kind of thing. But surely, John does not read a property or a kind. The same argument holds in the case of (47), which is a bare plural.

In some cases, paraphrases are forthcoming. For example, we might paraphrase (48-a) above as the claim that at one time John lacked the property of being diabetic, while at some later time he has it. But in general, such paraphrases are difficult to find without significant additions to our theory. Consider (49), which contains the adverb “rapidly”. Treating “rapidly” as a name of a modifier forces “learned” to take on a transitive reading, on which the subject learned the modifier. The other, superior option is to replace “rapidly” with “the property of being done rapidly.” But it is not the child that has this property. Rather, it was the event of learning that was rapid.²⁸ This pushes us toward a metaphysics that countenances events as well as individuals, and treats adverbs as properties of events. It pushes us toward a neo-Davidsonian language for our metaphysical theorizing; we will discuss this option at length below.

We now come to the most troubling cases. First, consider (51): “John needs something flammable”. Here, replacing “flammable” with a name, such as “the property of being flammable”, yields ungrammaticality. We might try to avoid this ungrammaticality by paraphrasing the original sentences as “John seeks a flammable thing”. But we still cannot remove “flammable” and replace it with a variable, on pain of ungrammaticality. Instead, we might try treating “a

²⁸Here I ignore the complication, noted by Davidson [1967, p. 38], that strictly speaking, being slow or rapid is not a property of an event. As Davidson points out, an event of swimming the English channel may be slow *qua* crossing but fast *qua* swimming, so the event itself is not fast or slow, absent further description.

flammable thing" as a complex name for the property of being flammable. But the problem then is that it is simply false that John seeks the property of being flammable. What John seeks is something that *has* that property. This suggests another paraphrase:

(59) John seeks something that has the property of being flammable.

But how can we paraphrase this? Here, "something" is not an ordinary wide-scope quantifier. In particular, (59) is not equivalent to (60):

(60) $\exists x$ [flammable(x) & John seeks (x)].

Nor would it be correct to paraphrase "seeks" as a propositional attitude; (59) is not aptly paraphrased as (61):

(61) John is trying to make it the case that $\exists x$ [flammable(x) & John finds x].

John is not trying to make it the case that anything exists, flammable or otherwise.

We encounter similar trouble if we try to paraphrase away any of the instances of Prior's puzzle in (52)-(55). In each case, simply removing the *T*-term and replacing it with an existentially quantified variable leads to ill-formedness. In each case, we can treat the complement as a complex name for a property, or a generalized quantifier, in line with the standard semantics for intensional transitive verbs. But if we then try to Ramsify that complex name, it yields an invalidity; ordinarily, we do not seek, need, want, resemble, simulate, or imagine properties.

Intensional transitive verbs thus pose a serious problem for Ramsification. On the one hand, a huge number of psychological and perceptual verbs are intensional transitives; they are essential to any serious theory of the mind. Consider the following list:

(62) covet, crave, desire, fancy, need, imagine, portray, think (of), be (about), think (about), believe (in), anticipate, expect, foresee, want, hanker (for), lust (for), thirst (for), yearn (for), prefer, hunt (for), scrounge (for), scavenge (for), seek, search (for), imitate, admire, disdain, fear, respect, worship, resemble, simulate, avoid, lack, omit, wait (for), plan, caricature, draw, represent, promise, recognize, indicate, point (to), signify, and portray.

This list is only a small portion of the total list of intensional transitive verbs. It would be hard to formulate a realistic psychological theory while excluding them from our theoretical vocabulary.

But on the other hand, intensional transitive verbs are the class of verbs for

which Prior's puzzle is most recalcitrant. We cannot replace components of the intensional noun phrases in the complements of intensional transitive verbs with existentially quantified variables. We also cannot we treat the noun phrase complements of intensional transitive verbs as complex names for properties, and then nominally quantify over those properties. As we've seen, such nominal quantification into the complements of ITVs is invalid. But finally, the vast majority of intensional transitives lack decompositions into propositional attitude verbs.²⁹ The result is that while some non-nominal positions can be assimilated to nominal positions via paraphrase, intensional transitive verbs cannot—they appear to be *essentially non-nominal*. Thus, we must either ban them from our theories, accept that Ramsification fails, or find a novel method of nominal paraphrase.

6. A Neo-Davidsonian Proposal

Saving Ramsification requires a solution to the generalized form of Prior's puzzle that allows us to treat every *T*-term as a name. I will not present such a complete solution here, for I do not have a solution that I am confident generalizes to every grammatical position for which Prior's puzzle arises. However, a proposal due to Graeme Forbes [2006, 2018] provides a partial solution that addresses what I take to be the cases of Prior's puzzle most resistant to paraphrase, including the cases of adverbial modifiers, the complements of intensional transitive verbs, and some adjectival verbal complements. To my knowledge, no other proposed solution to Prior's puzzle can accomplish even this, and so it appears that any complete solution to Prior's puzzle must build on, and so incorporate, the partial solution that I present here.

Recall above the case of adverbs such as "rapidly". Above I claimed that our best route to nominalizing such expressions was to treat them as names of properties, and then to use Lewis's method. There is already a kind of theory that treats adverbs in just this way: a neo-Davidsonian theory, on which adverbs denote properties of events. In such a theory, the semantics for (63-a) is given by (63-b):

- (63) a. The child learned rapidly.
 b. $\exists e[\text{learning}(e) \ \& \ \text{agent}(e, \text{the child}) \ \& \ \text{past}(e) \ \& \ \text{rapid}(e)]$

We can then paraphrase each of these predications in the way that Lewis suggests: with copulas. In this case, the event of learning *e* has the property of being rapid. Thus, there is initial appeal to conducting our metaphysical theorizing in a language that allows us to name and quantify over events—it allows us to

²⁹See Forbes [2006] and Montague [2009] for discussion.

nominalize adverbs.

But this is not the only appeal to going (neo-)Davidsonian. Forbes [2006, 2018] develops a neo-Davidsonian semantics for attitude verbs that allows for nominal quantification over the complements of both intensional transitive verbs and propositional attitude verbs—Forbes' theory solves Prior's puzzle for the case of both ITVs and propositional attitude verbs. Consider our recalcitrant examples involving ITVs from above:

- (64) a. John needs something flammable.
 b. $*\exists a \in D_{\langle e,t \rangle}$ John needs something a .
 c. $\exists a \in D_{\langle e,t \rangle}$ John needs a .
- (65) a. Sally resembles a psychopath.
 b. $*\exists a \in D_{\langle e,t \rangle}$ Sally resembles a a .
 c. $\exists a \in D_{\langle e,t \rangle}$ Sally resembles a .
- (66) a. Maxwell seeks a perfect gas.
 b. $*\exists a \in D_{\langle e,t \rangle}$ Maxwell seeks a a .
 c. $\exists a \in D_{\langle e,t \rangle}$ Maxwell seeks a .
- (67) a. The program simulated a catastrophic selloff.
 b. $*\exists a \in D_{\langle e,t \rangle}$ the program simulated a a selloff.
 c. $\exists a \in D_{\langle e,t \rangle}$ such that the program simulated a .
- (68) a. Mary imagined a frictionless plane.
 b. $*\exists a \in D_{\langle e,t \rangle}$ Mary imagined a a .
 c. $\exists a \in D_{\langle e,t \rangle}$ Maxwell seeks a .

Forbes solves Prior's puzzle for these cases by distinguishing between two different roles that the denotation of the complement of a verb can play in an event. On the one hand, it can serve as the *theme* of the event, as in (69):

- (69) a. John hit Bill.
 b. $\exists e$ [hitting(e) & agent(e ,John) & theme(e ,Bill)]

Here, Bill serves as the direct object of the event of hitting—he is what *gets hit*. Roughly speaking, the theme of a particular event V is what *gets V 'd*. By contrast, the objects denoted by intensional noun phrases in the complements of ITVs do not denote the theme of the event introduced by the verb. Consider (70):

- (70) a. Maxwell seeks a perfect gas.
 b. $\exists e$ [search(e) & agent(e ,Maxwell) & char(e ,the property of being a perfect gas)]

The notional reading of “seeks” occasions the introduction of a novel thematic role, “char”, which is short for “characterizes” or “is characterized by”. When

Maxwell seeks a perfect gas, but not a particular one, “a perfect gas” has a denotation—depending on one’s preferred semantics for intensional transitives, either a property or a generalized quantifier. Here I treat “a perfect gas” as denoting a property, but in either case, the denotation of “a perfect gas” is not what *gets sought*—John does not seek a property or a generalized quantifier. Rather, he seeks something that *has* the property of being a perfect gas.

With this novel thematic role in place, we can treat “a perfect gas” in (70-a) as a name, and then we can nominally quantify into the thematic role that it introduces:

- (71) a. Maxwell seeks a perfect gas.
 b. $\exists e$ [search(e) & agent(e ,Maxwell) & char(e ,the property of being a perfect gas)]
 c. $\exists P, e$ [search(e) & agent(e ,Maxwell) & char(e , P)]

(71-c) follows from (71-b): it says that there is some property that characterizes Maxwell’s search. This is a perfectly valid generalization, and it makes sense of the role that abstract objects play in the semantics of intensional verbs.

Forbes deploys a similar tactic to solve the problem in the case of propositional attitude verbs. Consider (72):

- (72) a. Mary fears that Fido bites
 b. $\exists e$ [fear(e) & in(Mary, e) & content(e ,that Fido bites)]
 c. $\exists p, e$ [fear(e) & in(Mary, e) & content(e , p)]

Here Forbes again introduces a thematic role, “content”, in order to specify the role that propositions play in states such as fearing, hoping, desiring, *etc.* The “content” role, like “char”, does not relate the event to its direct object or theme—the proposition is not what *gets feared*. Rather, the content role is what provides the state with its success- or correctness-conditions. Thus, the nominal quantification in (72-c) is perfectly intelligible, and follows from (72-a).

This allows us to Ramsify noun phrases in the complements of such verbs. In each of the cases above involving an intensional transitive verb, we let the verbal complement be a complex name for a property (or a generalized quantifier). We then remove that name and replace it with an existentially bound variable: we quantify into the “char” role. This allows us to offer definitions of terms such as “a perfect gas”, “a catastrophic selloff”, and “a psychopath”—each one serves as a name of a (complex) property. Thus, the neo-Davidsonian approach solves two of the central instances of Prior’s puzzle.

However, there is still a wide range of non-nominal positions for which no nominal analysis is forthcoming. For instance, it is not clear how to nominalize the adjectival complements of perceptual verbs from our examples from above,

repeated here along with the truth-conditions for their Ramsey sentences:

- (73) a. Sally feels emotional.
b. $\exists a \in D_{\langle e,t \rangle}$ such that Sally felt a .
- (74) a. Mary sounds depressed.
b. $\exists a \in D_{\langle e,t \rangle}$ such that Mary sounds a .
- (75) a. The fumes smell poisonous.
b. $\exists a \in D_{\langle e,t \rangle}$ such that the fumes smell a .
- (76) a. The spaghetti tastes delicious.
b. $\exists a \in D_{\langle e,t \rangle}$ such that the spaghetti tastes a .

There are many candidate paraphrases, but it is unclear how successful each is at capturing the meanings of these sentences while nominalizing their adjectival complements. Consider the following candidate paraphrases:

- (77) Mary sound like she has the property of being depressed.
- (78) Mary is like a depressed person in respect of how she sounds.

Both of these paraphrases seem to approximate the meaning of (74-a), but both have “depressed” in non-nominal positions of their own. An alternative is to extend the use of “char” above to these examples, as in (79) and (80):

- (79) a. Sally feels emotional.
b. $\exists e$ [feeling(e) & in(e ,Sally) & char(e ,the property of being emotional)]
c. $\exists P, e$ [feeling(e) & in(e ,Sally) & char(e , P)]
- (80) a. The fumes smell poisonous.
b. $\exists e$ [smelling(e) & theme(e ,the fumes) & char(e ,the property of being poisonous)]
c. $\exists P, e$ [smelling(e) & theme(e ,the fumes) & char(e , P)]

To extend the use of “char” in this way is, in effect, to turn it into a device for handling all non-nominal complements. But such uses begin to feel unconstrained. “Char” was designed specifically to account for the non-nominal complements of intensional transitive verbs, and in that case, there are clear principles governing its behavior. There are no corresponding principles in this case.

Here I will not take a stand on whether these approaches are adequate for the purposes of the nominalizer. Rather, since these are surely not the only remaining examples of non-nominal verbal complements, I simply present such cases as a challenge to the Ramsifier. If the Ramsifier wishes to define the theoretical terms of a realistic psychological theory—i.e. one that captures a wide range of mental states, perceptual states, and emotional states—they must find

a way to nominalize such non-nominal complements. The only alternative, on pain of giving definitions that are either incorrect or ill-formed, is to exclude such vocabulary from their theories.

7. Conclusion

We can now summarize our conclusions. Ramsification requires us to treat all theoretical terms as names, and in order to provide definitions of those terms, replaces those names with nominally quantified variables. But Prior's puzzle, whose scope has been drastically underappreciated, shows that attempting to assimilate expressions in a wide range of grammatical positions to names, and replacing them with nominally quantified variables, yields either invalidity or ill-formedness. Thus, Prior's puzzle, once fully appreciated, presents a serious challenge to Ramsification as a method of defining theoretical terms. If the postulate of a theory does not entail its Ramsey sentence, or has a Ramsey sentence that is ill-formed, then the corresponding definitions of theoretical terms will be either incorrect or nonsensical.

However, there is reason for measured optimism. Of the examples given, some were readily amenable to nominal paraphrase, and others could be treated with Forbes's neo-Davidsonian semantics. This approach has the consequence that if we admit intensional transitive verbs into our theories, and subsequently wish to Ramsify those theories, we will need to adopt a neo-Davidsonian language for our metaphysical theorizing. This has important metaphysical ramifications. Most importantly, we will, simply by dint of the desire to Ramsify, be committed to a metaphysics that includes events, and holds that such events have a rich structure that includes a range of roles that different objects can play in such events. The fact that a neo-Davidsonian semantics is required to handle many natural language constructions is not surprising. But the fact that we must use such a language for our metaphysical theorizing is surprising. Ramsification comes with costs and consequences.

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