

Fineness of Grain and Grounding: Towards a Lewisian Account

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Abstract:

Theories of grounding and ontological dependence raise a new challenge to the capacity of the Lewisian/Stalnakerian account of propositions to provide sufficient fineness of grain. In *On the Plurality of Worlds* (1986), Lewis argues that modal realism yields a satisfying theory of propositions as sets of worlds. But I will show that the propositions figuring in grounding statements must possess a finer-than-modal structure. I argue that the Lewisian theory can be modified to meet the challenge posed by grounding.

Any account must satisfy two desiderata: first, it must supply sufficient fineness of grain to make distinctions that are not captured by differences in possible worlds. Second, it must offer some sort of story about how these differences could be *in the world*. To show that a Lewisian-inspired approach is capable of satisfying the first, I propose a modification of John Bigelow's framework for belief contexts to account for the grounding operator.

With regard to the second desideratum, we have to distinguish two senses of worldliness. I claim that a theory is *strongly worldly* iff its content does not involve representational or mental items. Roughly speaking, it is *weakly worldly* just in case substituting expressions with other expressions that are referentially equivalent in the sentences of the theory does not affect the truth of the theory. The approach I suggest fails to be strongly worldly. However, it satisfies at least some forms of weak worldliness, and I'll argue that this is all that matters.

§0. New Grounds for Discontent in Paradise?

Theories of grounding and ontological dependence raise a new challenge to the capacity of the Lewisian/Stalnakerian account of propositions to provide adequate fineness of grain. In *On the Plurality of Worlds* (1986), Lewis argues that modal realism yields a satisfying theory of propositions: propositions are sets

of worlds, or, equivalently, functions from worlds to truth values.¹ Propositions so construed are mathematically and philosophically tractable: we can use them to provide well-behaved theories using the resources of set theory. If a proposition, p , is a set of worlds, then $\neg p$ is the complement of this set, and $\neg\neg p$ will be the complement of the complement—the original set, as we (or at least the classical among us) would wish. And if we like the idea that any worldly difference is a difference between one possible world and another, then we can enjoy the theoretical benefits of so-called ‘coarse-grained propositions’ in good conscience.

Coarse-grained propositions do not satisfy all the theoretical roles of propositions. In particular, the contents of belief and other intentional attitudes are more fine-grained than modal differences. Such attitudes are *hyperintensional*: we might doubt, believe, or hope that p is the case, while having no such attitude towards q , even though p and q are intensionally equivalent, that is, they hold in the same possible worlds. One particularly stark version of this problem emerges when we consider necessarily true propositions. Since necessarily true propositions are true in all possible worlds, the proposition *that kangaroos have pouches* will be true in the same possible worlds as the proposition *that kangaroos have pouches and there are infinitely many prime numbers*. But, of course, belief in the former is not equivalent to belief in the latter.

Lewis himself was well-aware of this problem. As he writes in “Attitudes *De Dicto* and *De Se*”: “You may think it goes without saying that the objects of attitudes are not sets of worlds because, for instance, believing that $2 + 2 = 4$ is not the same as believing that $123 + 456 = 579$ though both equations hold at exactly the same worlds—namely, all. I know perfectly well that there is such a thing as ignorance of noncontingent matters. I do not know what is the proper treatment of such ignorance” (1979/1983: 135). Both in his earlier “General Semantics” (1970) and in *Plurality of Worlds*, Lewis suggests ways of individuating content in a finer-grained manner, in order to account for such differences. Lewis’s strategy, along with similar approaches pursued by Max Cresswell (1975) and John Bigelow (1978), consists in building features of the way content is represented into the content itself. If such strategies can

¹In *Inquiry*, Stalnaker shows how an ‘ersatzist’ about possible worlds can help herself to this account of propositions. As Stalnaker makes clear, the account does not depend on modal realism. In what follows, I will focus on Lewis’s account for the sake of simplicity of presentation, but nothing will depend upon modal realism. Cf. Stalnaker 1984: 71-73.

be made to work formally, then it seems as though an approach that countenances merely intensional worldly differences—one using possibilities and possible worlds—could succeed as a theory of propositions: after all, propositional attitudes intuitively concern *how* we represent things, so it would make sense that they have to be sensitive to differences that result from our manner of conceptualizing. These approaches thus allow attitude ascriptions to be sensitive not just to worldly but also to representational differences.

But grounding claims are intended to capture worldly, non-causal, explanatory dependence relationships between the grounding and the grounded facts. For the sake of uniformity, I'm going to take "in virtue of" as the canonical form for expressing grounding claims. Grounding claims will have the form "The bird is red in virtue of the bird's being crimson." I will provisionally regiment claims of this form using the using the formulation $\ulcorner p \text{ in virtue of } q \urcorner$.² Such claims are typically taken to express a worldly, non-causal, explanatory dependence relationship between what obtains according to the left side and what obtains according to the right. This is sometimes captured by thinking of grounding as a relation among facts (Rosen 2009). Even those who, like Fine, do not wish to commit to this metaphysical story (2012) insist that grounding is not a matter of our representations but of ways things are in the world.³ If grounding is a relation among worldly entities, however, then these entities will have to possess a finer-than-modal structure. This fineness of grain is essential to the theoretical advantages grounding offers in capturing the particular nature of many philosophical claims.

This problem seems to show that the proponent of grounding must employ an alternative theory of propositions: the most popular such approach is a Neo-Russellian account according to which propositions are individuated

²Many different regimentations of grounding claims are possible. Some, including Kit Fine (2012) and Gideon Rosen (2010), prefer "fact that" idioms, while Benjamin Schnieder (2011) uses 'because' as a sentential connective. I prefer to use "in virtue of" rather than "because," on account of the very varied uses to which "because" is put in ordinary speech. "In virtue of" is more commonly used for the sort of non-causal worldly explanation that theorists of grounding have in mind.

³Fine (2012) proposes a state semantics for grounding claims. Roughly speaking a set of truths $\varphi_1, \dots, \varphi_n$ ground a truth ψ just in case whenever the verifiers for the grounding truths obtain the verifiers for the grounded truth also do so. The present paper attempts to provide one answer to what the verifiers for grounding claims might be—true propositions. There is thus nothing about the present account that is obviously incompatible with the model theory Fine provides, even though he himself appears to think of verifiers along the lines of states of affairs.

by their constituents and their manner of composition. These constituents are thus supposed to be worldly items. The Neo-Russellian account, however, faces well-known problems. While additional approaches have been suggested—including using circumstances or impossible worlds—no one has seriously considered modifying Lewis’s theory to deal with the problem. In this paper, I’ll argue that the Lewisian account is more malleable than one might think and evaluate it according to two criteria for a theory of propositions suitable for grounding.

Any account of propositions of suitable grain for handling grounding claims must satisfy two desiderata: first, it must supply sufficient fineness of grain to make distinctions that are not captured by differences in possible worlds. Second, it must offer some sort of story about how these differences could be *in the world*. A Lewisian-inspired approach is capable of satisfying the first desideratum. To demonstrate this, I propose a modification of Bigelow’s framework for belief contexts to account for the grounding operator. This shows that a Lewisian-inspired approach can satisfy the technical requirements of grounding.

To evaluate whether a Lewisian approach can fulfill the second desideratum, we have to distinguish two senses of worldliness. I will say that a theory is *strongly worldly* iff its content does not involve representational or mental items. Roughly speaking, it is *weakly worldly* just in case substituting expressions with other expressions that are referentially equivalent in the sentences of theory does not affect the truth of the theory. The approach I suggest fails to be strongly worldly. Different versions of weak worldliness can be distinguished depending on what the mental or representational items are taken to be. The approach I suggest fails to be strongly worldly. However, it satisfies at least some forms of weak worldliness, and I’ll argue that this is all that matters.

In §1, I will examine more carefully the difficulties with coarse-grained propositions and then briefly canvass proposed solutions. In the second section, I’ll sketch Lewis’s more refined account in “General Semantics” and *Plurality of Worlds*. Next, I will modify Bigelow’s framework for belief contexts to account for the grounding operator. This will show that a Lewisian-inspired approach can satisfy the technical requirements of grounding. In the final section, I’ll show that this account satisfies the requirement of weak worldliness and present my reasons for thinking this should be sufficient.

§1. Beyond Coarse-Grained Propositions

In order to gain a more precise understanding of the problem of fineness of grain for grounding statements, it is helpful to see more exactly why a coarse-grained possible worlds approach fails. As mentioned, I will take statements of the form $\ulcorner p$ in virtue of $q \urcorner$, where p and q are schematic propositional letters, as the standard form. The “in virtue of” is most naturally characterized as an operator taking pairs of sentences to sentences. The problem, however, applies equally well to a regimentation of grounding as a predicate that takes singular terms, e.g. terms for facts, and creates complete sentences. In this sense, the problem of fineness of grain is orthogonal to that of what the logical form of grounding claims might be.

To see why coarse-grained propositions are disastrous in grounding statements, consider the statement that *grass is grue in virtue of grass being green*,⁴ where to be grue is to be green before the year 3000 or blue thereafter. This seems to be a relatively uncontentious grounding claim: it seems that what *makes it the case* that grass is grue is that grass is green. Now, one of the characteristics of the grounding relation (even though I am treating the logical form of grounding statements as involving an operator, I take it that grounding itself is something like a relation, most likely between higher-order entities) is asymmetry: if it is the case that p in virtue of q then it is not the case that q in virtue of p . Since we are concerned not just with total grounds but with partial grounds, this principle can be strengthened to say that if p obtains partially in virtue of q then it is not the case that q obtains partially in virtue of p (Rosen 2010: 116). Rosen defends strong asymmetry by noting that since grounding is supposed to track items in an explanatory hierarchy, if something is in a ‘lower’ level of the hierarchy, then it cannot also be in a higher level. While the principle is not utterly uncontentious (Jenkins 2011), it is among the bedrock characterizations of grounding. But consider what happens in our candidate case if we assume coarse-grained propositions. We denote the name of the proposition φ with angle brackets as $\langle \varphi \rangle$. Since grass is green in exactly the same worlds in which grass is green and not blue, $\langle \text{grass is green} \rangle$ is identical to $\langle \text{grass is grue and$

⁴Note that there is some distortion of the natural language sentence in characterizing this as having the form $\ulcorner p$ in virtue of $q \urcorner$, since the verb occurs in a gerundive rather than finite form. I will assume that this is a surface feature of the English locution and not reflected in logical form.

not blue after the year 3000>. Grass is grue and not blue after the year 3000 partially in virtue of grass being grue, by the principle that a conjunction is partially grounded in each of its conjuncts. But, substituting assumed equivalents, we now have that *grass is green partially in virtue of grass being grue*, violating asymmetry.

Examples of this sort can be multiplied. For a case that violates irreflexivity, let us take two necessarily coextensive propositions: <Mary won the race> and <Mary won the race and $2 + 2 = 4$ >. Using the same principle that conjunctions are partially grounded in their conjuncts, we can say that *Mary won the race and $2 + 2 = 4$ partially in virtue of Mary's winning the race*. Under the assumption that intensionally equivalent propositions are equivalent, we then get that *Mary won the race partially in virtue of Mary's winning the race*. (Note that we also get the prima facie implausible claim that Mary's winning the race is partially grounded in any arbitrary necessary truth!).

The incompatibility of grounding with a possible-worlds approach to propositions is unsurprising, since grounding was introduced to capture explanatory connections missed by an intensional approach, but it's worthwhile to note how quickly one runs into problems. Furthermore, these are difficulties that one cannot escape by taking grounding as a relation between facts. Consider Rosen's preferred formulation, *the fact that q grounds the fact that p* , for short: $[p] \leftarrow [q]$. If we were to assume a coarse-grained framework, then the same substitutions could be done within the term-forming operator, 'the fact that ...'.⁵

These considerations might suggest that we should instead take a maximally fine-grained approach and eschew *any* sort of substitution within grounding claims. On this approach, grounding claims would have the same fineness of grain as sentence types individuated as strings of symbols. I think, however, that this would be going too far. First, it would seem to make grounding contexts as fine-grained as quotation, and it is difficult to see how they could then be claims about the world. Second, the identity of a grounding claim is plausibly preserved under transformations of bound variables—those that correspond to α -transformations within the lambda calculus. For instance, a statement of the form $\ulcorner \forall x(Fx) \text{ in virtue of } Fa \urcorner$ seems to have the same content as $\ulcorner \forall y(Fy) \text{ in virtue of } Fa \urcorner$.

⁵Rosen, of course, is aware of this, which is why he stipulates that facts are to be individuated as finely as sentences, blocking the sort of problematic substitutions I've made here.

Moreover, it's at least intuitively plausible that the same grounding claims can be made in different languages. Now, care here is required, since different natural languages express dependence relations with slightly different syntactical constructions. Nevertheless, if we allow (as seems plausible) that 'because'-like constructions do often express grounding claims, it seems that there will be sufficient overlap among many natural languages to build a case. Consider the following sentence pair:

- (1) The bird is red because the bird is blood-red.
- (2) Der Vogel ist rot, weil der Vogel blutrot ist.

It would seem that the intuitions in favor of taking these sentences as saying the same thing are just as strong as those in favor of taking classically extensional or intensional sentences to have equivalent contents.⁶ Finally, we might take the difference in formulations of grounding claims within a language—viz. the felt equivalence of 'because,' 'in virtue of,' and 'grounds'—to be evidence that we're making the same claims in different ways. It seems as though substitution by synonymous isomorphism is permitted within grounding claims [Church 1954; Anderson 1980]. The upshot seems to be that we need an approach to the individuation of propositions within grounding claims that is finer-grained than offered by possible worlds semantics and coarser-grained than sentence types.

There are, broadly speaking, at least four kinds of approaches to getting the fineness of grain required for grounding: first, one might take propositions to be structured, in a broadly neo-Russelian manner. If propositions are individuated by their constituents and the manner of their combination, then it at least seems that there is room for distinctions that cut finer than truth in worlds. This seems to be the most popular approach and to be at least implicit in most treatments of grounding (indeed, this seems to be Rosen's own preferred framework when confronted with issues of the grounding–reduction link). Second, one might enrich our ontological stock with impossible worlds and incomplete worlds in order to distinguish between necessarily coextensive propositions. I'll

⁶Of course, not everyone agrees that sentence pairs in different languages that are merely extensional express the same proposition. See King (2013) for a dissenting view, and one might go so far as to deny the existence of any synonyms at all, thus banning such sentence pairs in general. I don't wish to take a stand on this here but merely to make the point that the sameness of content of grounding-pairs is as well-off as more familiar cases.

follow David Ripley in calling this sort of approach ‘circumstantialist’ [2012]. Third, one might adopt a sort of primitivism about propositions, making use of higher-order quantification over these *sui generis* ‘entities’ and defining a notion of propositional equivalence axiomatically. Finally, one might take a modest approach, as I suggest, and modify the possible worlds framework, borrowing from the Fregean tradition of thinking about meaning in addition to intension.

(I) **Neo-Russellianism:** Though many different varieties have been proposed in recent years,⁷ structured theories of propositions start from the core idea that propositions are individuated by their constituents and their manner of composition. Those who hew to the original Russellian line hold that these constituents are worldly entities—objects such as Mont Blanc, trees, and tables; properties such as being-so-and-so-meters-tall, being coniferous, or being wobbly; and relations. It is helpful to start with a very simple account to see how such theories can handle our problem of fineness of grain. On such an account, the proposition expressed by a sentence in a context consists of an n -tuple of objects, properties, and relations, roughly corresponding to the semantic values of the syntactically individuated items within a sentence. For example, the sentence “The ball is red” expresses the propositions $\langle ball, Red \rangle$, while the sentence “the ball is red and the ball is round” would express the proposition $\langle CONJ, \langle ball, Red \rangle, \langle ball, Round \rangle \rangle$. The constituents of these tuples are the ball, the values of “red” and “round”—properties, and the value of “and”—a function from propositions to propositions.

Structured propositions provide far greater fineness of grain than possible worlds accounts: there are many necessary propositions, as well as many impossible ones, since the constituents can differ. And it seems that Russellian propositions are also well-suited to handle the kinds of grounding claims we have considered. For instance, the proposition expressed by *grass is green* will differ from that expressed by *grass is grue and grass is not blue*, where to be grue is to be green or to be blue after the year 3000, since the former will include the value of “green” as a constituent, while the latter will include the values of “and,” “grue,” “not,” and “blue.” For this reason, most advocates of grounding at least implicitly rely on a structured proposition account.

⁷See, e.g. King, Soames, and Speaks (2014) for an overview of the debate, as well as King (2013)

While the advantages of a neo-Russellian approach are many, I think there are sufficient worries about such theories to make it worthwhile to examine alternatives. Recent proponents of structured propositions have developed theories that respond to concerns regarding the sort of simple Russellian account I've sketched here, such as the so-called "Benacerraf problem" of multiple, equally good representations of one content, the question of how a set or n -tuple could have a truth value (or be a representational entity at all), and, perhaps most famously, the issue of what the unity of the proposition could consist in (see, again, King, Soames, and Speaks 2014). But even sophisticated recent accounts of structured propositions have not provided a logic for propositions that would be free from paradox.⁸ Conceiving of propositions as composed out of constituents that themselves can include further constituents seems to leave these accounts open to "diagonalization" arguments, such as Russell's own Appendix B paradox (1903) and Myhill's proof that Church's logic of sense and denotation contains a contradiction (Church 1953; Myhill 1958). Although one might think that such paradoxes threaten any sufficiently fine-grained account, Neo-Russellians are particularly vulnerable because they are committed to the central premise that propositions are objects. Neo-Russellians think of propositions as either mereological composites or set-theoretic constructions, and either way these count as objects. This commitment prevents Neo-Russellians from adopting—at least in any straightforward way—a strategy, available to other proponents of fine-grained accounts, of adopting a type theoretical framework to block the paradox.

Another worry concerning at least King's linguistic version of Neo-Russellianism concerns whether his account individuates propositions so finely that they cannot fulfill the theoretical roles classically assigned to propositions and whether such an account makes propositions unduly language-dependent. For instance, the linguistic criterion of individuation for propositions means that a sentence in a language expresses a different proposition from its canonical translation in another language. While King (2013) argues that this is a theoretical benefit of his account, there are reasons to be sceptical. Propositions are commonly taken to be mental contents, and it would be cost to say that the same mental content cannot be expressed in two different languages. Similarly, King holds that a sentence in the active mood always expresses a different proposi-

⁸See Deutsch (2008) for a particularly forceful version of this objection.

tion from its passive counterpart. Once again, this seems to collapse propositions into sentences themselves. In any event, it does not appear to provide the right fineness of grain for a criterion of intersubstitutability in grounding claims. If we want to hang onto the idea that different formulations of grounding statements can have the same content, then we need a sense of content that is not individuated so finely as King's.

While the previous objection concerned whether the Neo-Russellian account individuated propositions too finely, David Ripley [2012] argues that propositional structuralism, by itself, cannot provide sufficient fineness of grain.⁹ Ripley introduces several examples of 'Frege puzzle' cases and notes that propositional structure alone will not allow us to make the hyperintensional differences these cases call for. Take, for instance, Ripley's example of the sentences: "Tamy fears that all woodchucks are woodchucks" and "Tamy fears that all woodchucks are whistle-pigs" [104]. "All woodchucks are woodchucks" and "all woodchucks are whistle-pigs" are both necessarily true. Nevertheless, as Ripley suggests, if Tamy knows he's been bitten by a woodchuck, suspects but does not know that all woodchucks are whistle-pigs, and knows that he is allergic to whistle-pigs, it is plausible that he fears all woodchucks are whistle-pigs without fearing that all woodchucks are woodchucks [104]. The Neo-Russellian, however, does not have the resources to explain this sort of case: both propositions have the same worldly constituents, since "woodchuck" and "whistle-pig" refer to the same entities, and they are arranged in the same manner. But since this case looks just like the sort of case that motivates fine-grained propositions and it seems that structure itself is useless in dealing with this case, Ripley concludes that structuralism is not an adequate response to fineness of grain concerns [105–109]. The problem here is that Neo-Russellianism has no means to accommodate differences in cognitive significance—the sort of differences that the change truth value of propositions involving intentional attitudes—arising from different individual terms. As we will see,

⁹Ripley's argument is addressed against both Neo-Russellian and broadly "Neo-Fregean" accounts, including the Lewisian theory I will defend. As will become clear, however, I think his argument does not work for the form of structuralism defended here. The common core of structuralism, in Ripley's view, is the claim that propositions have a structure corresponding to the syntactic structure of the clauses that denote them [2012: 100]. Since I don't think that Ripley's argument works against all views that are structuralist in this sense but that it is successful against Neo-Russellian accounts, I will consider it merely as an objection to Neo-Russellianism here.

the Lewisian approach I suggest can account for these differences by making the truth value of propositions involving opaque contexts sensitive to linguistic expressions.

(II) **Impossible Worlds:** The idea in using impossible worlds would be that even if two propositions agree in truth value at all possible worlds, they could differ in truth value at some impossible world. While impossible worlds may be useful in dealing with many hyperintensional phenomena, and in particular with non-trivial counterpossibles (Nolan 1997), it is not clear that they would, on their own, be able to provide the proper criterion of individuation of propositions. Unlike Lewisian worlds, impossible worlds would be abstract rather than concrete—and, on one straightforward treatment, be composed out of collections of propositions. But if impossible worlds are collections of propositions, what impossible worlds there *are* depends on how we individuate propositions. It then starts to look like such an account will be of limited use in explaining content. For instance, Nolan suggests the comprehension principle: “For every proposition which cannot be true, there is an impossible world where that proposition is true” [1997: 542]. In some cases, we do have intuitions about what would constitute two different ways a world couldn’t be: $2 + 2 = 4$ failing to hold would be a different way the world couldn’t be from one in which $2 + 3 = 5$ fails to do so. But other cases are less clear.

Instead of using differences in true propositions as our criterion for distinctness of impossible worlds, we might instead use something like structured propositions. The idea would be to fix a stock of atomic properties and then allow their truth values of these primitives and for logical constructions out of them to vary freely. But how is the stock of primitive properties to be fixed? Is being identical to Hesperus a different property from being identical to Phosphorus? Is trilaterality different from triangularity? Being the successor of one and being two? Since it’s not clear how to adjudicate these questions, it does not seem as though turning to impossible worlds will alone ensure sufficient fineness of grain for grounding claims. On the other hand, following Godard and Routely [1973] and Priest [2005], we might instead identify worlds with sets of sentences which are true in these worlds. To accommodate sameness of meaning, propositions would have to be identified with sets of worlds in which a sentence, *s*, or any of its synonyms would be true. Both kinds of account would have to add some sort of substantial criterion of identity and distinctness for

propositions.

Even if circumstantialism only offers a setting in which different solutions might be offered, it is a promising approach. Nevertheless, there are some features of circumstantialism that are worrying enough to make us look around for alternatives. One worry concerns what logic governs our reasoning over all sets of circumstances. While Nolan [1997] and Ripley [2012] provide frameworks that preserve a classical consequence relation and permit the logical constants to behave classically over possible worlds, there is no general logic for what we are permitted to reason within a circumstance. On Nolan's view, we engage in a kind of subjunctive reasoning that does not obey any particular logical canons but which operates according to intuitive principles. Hyperintensional reasoning is assimilated to the informal reasoning that we do under a counterpossible supposition. But we might suspect that this isn't what's going on in hyperintensionality in general, where it seems that we can reason classically, but with additional entities: the intuition here is that the logical constants retain their meanings, and classical laws hold, but that additional differences—differences in sense—are on the table.

(III) **Primitivism about Propositions:** Rather than either taking propositions to have constituents or identifying them with sets of worlds, primitivists consider propositions to be simple, *sui generis* entities (Bealer, 1979, 1998). Bealer develops logical systems for two types of intensional entities—coarse and fine-grained—and devises an axiom system and algebraic semantics for each (1979). In Bealer's view, both types—as well as a system that integrates them—are necessary to vindicate inferences involving belief-operators and modal claims that we intuitively think of as valid (1979: 634). On the coarse-grained conception, two propositions are identical just in case they are necessarily equivalent, but on the fine-grained conception “each definable intensional entity is such that, when it is defined completely, it has a *unique, noncircular definition*” (1979: 636). The idea here is that some necessarily equivalent propositions will have different definitions. For instance, necessarily, “This is water” is true just in case “This is H₂O” is true, but, intuitively, the ‘definitions’ of these propositions are different. His logical axioms for fine-grained intensional entities are meant to formally capture this notion. It is somewhat odd, however, to speak of ‘definitions’ of propositions—Bealer's account is supposed to hold for properties, relations, and propositions and he takes cases of properties, where it's

easier to fathom what a definition might be, for his examples. As Anderson (1987: 118–122) points out, Bealer thinks of definition as an *ontological* notion, rather than a linguistic one, and it seems as though finding the correct definitions is a matter of philosophical analysis. Here, one might worry both about the prospects for arriving at a unique analysis of all intensional entities—Anderson offers some plausible cases of multiple, equally attractive, candidate analyses—as well as about the explanatory punch of Bealer’s theory. Bealer’s logic takes for granted that such an analysis has already been completed, but doesn’t indicate what it consists in or why it is that intensional entities individuated by definitions are well-suited to be the objects of intentional attitudes. This approach differs from one—like that to be offered here—that takes surface, linguistic form as a guide to propositional identity. A method that starts from sentences, rather than intensional entities with philosophical definitions, can start from common, semantical data.

Cian Dorr (MS) has recently begun to develop a different sort of axiomatic account of metaphysical equivalence that would be directly tied to fundamentality and grounding. Dorr starts by proposing candidate axioms governing the binary operator in statements of the form ‘To be an *F* is to be a *G*.’ His rough idea is to develop criteria for metaphysical equivalence, where metaphysically equivalent statements are those that preserve truth when substituted for one another in worldly contexts. He then uses these criteria to construct an analysis of metaphysical priority by distinguishing between what is really primitive and what is defined. This distinction should show up in an asymmetry between what can occur within different embeddings on the left and the right side of metaphysical identifications. While Dorr does not have a settled account, it’s worth mentioning his strategy, because his analysis suggests that while the content figuring in grounding contexts must be finer-grained than functions from possible worlds to truth values, the metaphysically relevant content is individuated more coarsely than that which figures in attitude ascriptions. For instance, replacing a sentence *p* with $\neg\neg p$ can change the truth value of belief, knowledge, and desire ascriptions but, according to Dorr, the former is metaphysically equivalent to the latter.

Dorr argues that we must reject some of the principles suggested by advocates of grounding, because he holds that the world does not make such fine discriminations. While he does not commit himself to the principle that

all propositional-logical equivalents express the same worldly content, he endorses the worldly indistinguishability of at least some pairs of logically equivalent propositions. For instance, he holds that a proposition and its double negation express the same state of affairs and that applying de Morgan's laws yields worldly equivalents. He is motivated by Ramsey's imagined language in which negations are written upside down (Ramsey 1927: 42–43). A doubly negated expression would thus just be the original expression. Insofar as we take this form of language to be metaphysically equivalent to our own, then the difference between p and $\neg\neg p$ must be an artifact of our manner of symbolization. Similar constructions would apply to the case of de Morgan's laws.

This conclusion should be resisted. It seems far from obvious that Ramsey's candidate language *is* as perspicuous as our own natural and formal languages. It is inadequate to express even moderate denials of the law of excluded middle. The schematic form of excluded middle, $p \vee \neg p$, will be the notationally same formula as the schema of non-contradiction $\neg(p \wedge \neg p)$. Take the schema for non-contradiction: if we begin our translation from the inside, we first get $\neg(p \wedge \neg p)$. To turn the outer expression into Ramsey's notation, we then flip everything in parentheses to get $p \vee \neg p$, which is just the schema form of the law of excluded middle. Parallel reasoning applies if we start from the law of excluded middle.¹⁰ Thus, there is no way to write out denials of logical laws and the language will be too impoverished to express, for instance, the claims of three-valued logic.¹¹ Now, one might respond that such debates concern the principles governing our reasoning and are artifacts of our particular manners of symbolization. While I think this response can be questioned for independent reasons, even those sympathetic to this view have reason to be unhappy with Ramsey's language: for to accept this sort of language as metaphysically adequate is *not* to somehow 'factor out' differences internal to our manner of representation. It is instead to entrench one particular theory of reasoning, the fully classical, and say that it is the only form of reasoning available. Choosing Ramsey's language prejudices questions that are more properly left to meta-

¹⁰And, of course, it is inadequate even to formulate intuitionistic negation. It is thus at least inferior as a language in which debates between classical and non-classical logicians could be posed.

¹¹One might, of course, circumvent the problem by adding expressive resources such as predicates for true, false, and truth-valueless, but this doesn't affect the point that Ramsey's language alone cannot even write claims that are formulable in the standard notation and is thus expressively impoverished.

physical inquiry. Insofar as we think we should at least be open to revising our logic at least for certain specific cases or for choosing among logically equivalent grounding claims, we should view our languages as superior to Ramsey's.

If we reject Ramsey's and Dorr's account of metaphysical equivalence, then we can retain the differences required for classical principles of grounding. The concerns raised, however, only tell against the coarse-grained criterion proposed, rather than to primitivism about propositions per se. A new form of propositional primitivism could be developed that would offer an account of propositional equivalence better suited for grounding contexts.

Now that we've briefly canvassed rival views, I would like to turn to Lewis's own discussions of how a possible worlds framework can be adapted to contexts in which finer-grained entities are required. This will allow us to gain some traction on whether we can modify the possible worlds framework to handle hyperintensional worldly relations or whether we need new sorts of ontological resources.

§2. A Lewisian Framework for Fine-grained Meanings

Lewis treated propositions as sets of possible worlds (1984: 53; 1983: 134). He is skeptical that we are picking out a single, well-defined thing with our 'proposition'-talk, but he considers the different candidate roles for propositions and is happy to allow (and seems to think it required) for different entities to fulfill these different roles. In *Plurality*, for instance, he notes that propositions are sometimes thought of as the bearers of truth or false simpliciter and sometimes considered 'the objects of thought' (1984: 54). Sets of possible worlds are well-suited for the former role, while 'egocentric propositions,' sets of individuals, are more suitable for the latter. Indeed, Lewis even introduces a structured proposition account and notes that it might be well-suited for describing information exchange, noting that we are already committed to the objects required for a structured proposition account (1984: 57-59).

Before turning to Lewis's different strategies in *Plurality*, however, I'd like to look briefly at his account of sentence meaning in his earlier essay, 'General Semantics' (1970). The meaning of a sentence, as considered in that essay, is distinct from the proposition expressed by a sentence. Sentence meanings are far more fine-grained. There is, however, a close connection between proposi-

tions and sentence *intensions*. A set of possible worlds is equivalent to a function from worlds to truth values. Since sentence intensions are functions from different parameters—including one for worlds—to truth values, then if the other parameters are determined by context, a sentence intension is equivalent to a proposition. This suggests that it might be helpful to examine the relation between sentence intension and sentence meaning in order to develop a finer-grained account of propositions.

In ‘General Semantics’ (1970), Lewis develops a framework for figuring out what meanings are and a theory of how the meanings of sentences are derived from the meanings of the component expressions. He starts from a categorial grammar in which each expression belongs to a particular category, which is either basic or derivative. He provisionally takes the basic categories to be sentence (S), name (N), and common noun (C); the meaning of an expression belonging one of these categories determines the *extension* of the term in that category, where the extension of a sentence is a truth-value, the extension of a name is the thing named, and the extension of a common noun consists of the things to which the common noun applies (194). So, one of the jobs of the meaning for any basic expression is to serve as a function from an input—an n -tuple consisting of coordinates that form an index—to the category-appropriate extension. These functions are the intensions of the basic categories.

Derived categories are those that take expressions of some categories, c_1, \dots, c_n , and make an expression of another category, c , so the intension of an expression belonging to any derived category is a function from the intensions of the expressions from which the expression is derived, c_1, \dots, c_n , to the intension of the category c . For example, since a predicate is of type S/N—it takes a name and makes a sentence—the intension of a predicate is a function from name-intensions to sentence-intensions. Since the intension of a name is a function from an index to a thing and a sentence is a function from an index to a truth value, the intension of a predicate is a function from a function from an index to a thing to a function from an index to a truth value.

Meanings are not simply intensions, however, because compound expressions can differ in meaning despite having the same intensions (200). For instance, contradictions all have the same intension: they take any index to false. (Just as there is only one necessarily false proposition). Compound expressions can differ in meaning despite having the same intension if the intensions

of their constituents differ. For each expression, we then build a tree: if the expression is simple, the tree consists of a single node, with a category and intension. If the expression is complex, the top node will be the category and intension of the expression, and below it will be nodes consisting of pairs of categories and intensions for each of the expressions from which the original expression is derived. This procedure will be repeated until simple expressions are reached. The nodes arranged in this way form the tree for an expression. With this procedure in place, we can now see Lewis's definition of the meaning of an expression:

We now define a *meaning* as a tree such that, first, each node is occupied by an ordered pair $\langle c \ \varphi \rangle$ of a category and an appropriate intension for that category; and second, immediately beneath any non-terminal node occupied by such a pair $\langle c \ \varphi \rangle$ are two or more nodes, and these are occupied by pairs $\langle c_o \ \varphi_o \rangle, \langle c_1 \ \varphi_1 \rangle, \dots, \langle c_n \ \varphi_n \rangle$ (in that order) such that c_o is $(c/c_1 \dots c_n)$ and φ is $\varphi_o(\varphi_1 \dots \varphi_n)$. (202)

The category of the rightmost child node is that which takes expressions belonging to the categories listed in the rest of the row and makes an expression of the category of the original node. The intension of an expression is the function that results from applying the function ϕ_o , the intension of the first constituent, to the inputs ϕ_1, \dots, ϕ_n , the intensions of the subsequent constituents.

Two expressions thus have the same meaning just in case they have the same tree. For simple expressions, meaning coincides with intension, but the meaning of compound expressions also depends on the categories and intensions of their constituents. Thus, while the framework is, in general, much finer-grained than that provided by intensions alone, Lewis denies that there might be differences in meaning between simple expressions—for instance, lexically singular terms for properties—that have the same intensions. For properties named by simple expressions, the 'General Semantics' approach is equivalent to a coarse-grained possible worlds account of properties. While there are not obvious instances of intensionally-equivalent properties with simple canonical names figuring in different grounding claims, such a scenario appears at least conceptually possible. For instance, we might imagine two physical properties that bear the simple, canonical names 'M' and 'E' and imagine that these properties are present in just the same possible situations. Since they would

‘co-vary’ and the intensions of their names would be the same, Lewis’s framework would consider them to be one property. Nevertheless, there might be good metaphysical reasons to think they are two, since, for instance, it might be that they figure in different explanatory relationships.

One possibility for circumventing this problem is to claim that even if a particular language employs lexically simple canonical names for such properties, such names must be complex on the level of logical form, since otherwise it would be mysterious how they could serve in different explanatory relations. The idea here would be that the logical form would track whatever relations among properties are captured by the explanatory connections we endorse. One indication of this might be our intuitive acceptance of different judgments of the triviality of equivalences. As Lewis notes in *Plurality*, it seems that triangularity is trivially co-extensive with triangularity, while trilaterality is non-trivially co-extensive with triangularity (1986: 56). Presumably, our judgments of triviality are not only sensitive to the complexity within these common names but will track differences in the way in which such properties figure in explanatory relations.

Thus, since sentence meanings are significantly finer grained than sentence intensions, such meanings appear well-suited to play the role of fine-grained propositions. Lewis suggests this in his discussion of content in *Plurality* (1984: 57). He views such fine-grained entities as ontologically unproblematic since, “[we] must [believe in them], if we believe in properties and we believe in individuals and we believe in ordered pairs of things we believe in” (57). Lewis’s point here is that these structured propositions are simply constructions out of entities to which we are already committed using a procedure that we regard as generally unproblematic.

According to the construal of propositions as sets of worlds and of properties as sets of (possible) individuals, propositions are a particular kind of property: those instantiated by an entire possible world. (The correspondence between propositions and properties provides the first step in Lewis’s argument in ‘Attitudes *De Dicto* and *De Se*’ that properties are, in fact, the object of so-called propositional attitudes (1983: 137)). He can thus offer one basic account of structured properties that is likewise applicable to propositions. He considers the aforementioned case of trilaterality and triangularity (1984: 56). He lets the difference in meaning between having three sides and having three angles

guide our analysis of these properties and notes that we can analyze the properties as in the one case of the pair $\langle T, S \rangle$, whose members are a higher-order unstructured relation, T , holding between an unstructured property of individuals and an unstructured relation of individuals just in case exactly three things bear the relation to the property, and an unstructured property of sidedness. Triangularity would be the ordered pair $\langle T, A \rangle$, made up of the same relation and the property of angularity (56–57). He extends this construction first to relations and then to propositions, giving a general idea of an account of fine-grained entities modeled on the semantic framework of meanings.

It's perhaps important to note that despite this ecumenicism, Lewis did not appear to seriously consider using meanings in his theory of propositional attitudes. Indeed, as far as I know, he never discussed this proposal at any length. This is surprising, since he was aware of (and cited in passing) Max Cresswell's (1975) and John Bigelow's (1978) developments of the framework of 'General Semantics' for hyperintensional operators. One hint Lewis does give, however, concerns the problem of the 'trivially' operator. 'Trivially' takes a sentence as an argument and outputs true just in case the sentence in the argument is—in the intuitive sense—obviously analytically true (1984: 50). In other words, it wears its truth on its face. For instance, 'Trivially, it rains iff it rains' is true while 'Trivially, Hesperus is identical to Phosphorus' is false. Since the embedded sentences express necessarily equivalent propositions, 'trivially' is a hyperintensional operator. If hyperintensional operators such as 'trivially' are incorporated into our language, then how are we to understand their semantic value? It seems that we are going to run into set-theoretical problems if they can be iterated, as in the sentence 'trivially trivially it rains iff it rains,' since this sentence would take as an argument "a function outranking the function itself in the set-theoretic hierarchy, which is impossible." (1984: 50). Lewis seems to be pointing to a problem regarding self-reference: if 'trivially' denotes a function in the set-theoretic hierarchy at some level κ and if functions' arguments always occur at a lower level than the function itself, then 'trivially' must express a function that occurs at both κ as well as the next level. This technical difficulty—and dissatisfaction with Cresswell's and Bigelow's attempted fixes—might have made Lewis wary of hyperintensional operators; however, I think there is another reason for his reluctance to use meanings to explain the hyperintensionality of beliefs.

As he notes in *Plurality*, Lewis thinks that the contents of beliefs are derived from decision-theoretic principles concerning total belief/desire states. These principles pick out centered worlds—that is, egocentric propositions—according to a principle of best fit. This principle of fit is ‘constitutive’ of belief for Lewis (36). Then, in a separate step, a semantic theory provides a function from sentences to sets of centered worlds. It is true that a subject, *S*, believes a sentence, *P*, then, just in case *P* is true in all centered worlds in *S*’s belief state. Since belief-desire pairs pick out a set of centered worlds, there is nothing on the side of psychology that would correspond to syntactically individuated meanings. In order to explain cases in which it looks as though a subject fails to believe the results of failures of necessary equivalents, Lewis instead invokes phenomena like doublethink, in which a subject has two incompatible belief states, as well as acquaintance under a particular name (as in Kripke’s Londres/London cases).¹² Now, this might seem to point to an inadequacy of the belief/desire framework he uses, but Lewis notes that structured propositions will not in fact explain all the cases of failure of logical omniscience. In particular, they seem unsuited to explain the London/Londres puzzle, since the structured propositions believed would be the same. This makes Lewis suspect that the right account of failures of intersubstitutability are not due to finer-grained beliefs but to additional factors. If this is the case, then he doesn’t see any reason to give up the belief/desire account of the individuation of beliefs.

Whether or not Lewis is correct regarding the proper explanation for failures of substitution of necessary equivalents in belief contexts, however, the story will not be available for grounding. Grounding, as we have seen, is a hyperintensional worldly relation. So, explanations in terms of doxastic acquaintance relations or relations to terms or variants in meaning across different worlds are not going to help. Instead, it is more promising to turn to

¹²Stalnaker defends a similar conception of beliefs as sets of possible worlds in *Inquiry*. He explains cases of a subject believing that *P* while failing to believe that *Q* for necessarily equivalent *P* and *Q* by saying that the subject does not know the relevant linguistic fact that the sentences *P* and *Q* express the same proposition (1984: 72). He notes that while this explanation is immediately satisfying for belief in tautologies—where someone fails to believe a sufficiently complex tautology, it seems plausible to attribute this to failing to understand the sentence that expresses it in a particular language—it is less intuitive for mathematical cases. In the latter sort of case, he argues that the unknown sentences are something like abstractions that can be constant across languages. So, if someone fails to know that $256 \times 59 = 15,104$, then she will fail to know that a whole class of sentences (for instance, the sentence in binary, in Roman numerals, etc.) expresses the true. For discussion, see (1984: 72–77).

accounts that use meanings to incorporate hyperintensional operators. I will take Bigelow's framework as our model, because it is relatively straightforward to see how we could incorporate a grounding operator into his semantics.

§3. Bigelow and Grounding

Bigelow (1978) adapts the framework of Lewis's 'General Semantics,' drawing on Cresswell's (1975), to provide a semantics capable of dealing with hyperintensional operators, including belief. Bigelow characterizes his approach as neo-Fregean, because he does not directly construct structured propositions out of worldly constituents, as the neo-Russellian does, but uses functions to build up semantic structures. I will show how Bigelow's framework can be applied to grounding contexts. Bigelow's treatment hews closely to Lewis's own, providing compositionally determined values and meanings for each expression in the language. As in Lewis, the meaning of a basic symbol, α , symbolized $M(\alpha)$, will be equal to its value, $V(\alpha)$. Meanings of complex expressions will be determined compositionally, so that if $\alpha = \langle \delta, \alpha_1, \dots, \alpha_n \rangle$, then $M(\alpha) = \langle M(\delta), M(\alpha_1), \dots, M(\alpha_n) \rangle$. There are several distinctive features of Bigelow's semantics that bear mentioning. First, rather than taking meanings themselves as the arguments for hyperintensional operators, he assigns each meaning a semantic marker to serve as the argument. The reason for this is to allow for embeddings under multiple hyperintensional operators. If the meanings themselves were used, then functions would take themselves as arguments, violating standard set-theoretic practices. Second, in a neo-Fregean vein, Bigelow takes operators, such as belief, to be sensitive not only to the meanings but also to the expressions within belief-sentences. As a result, he defines semantic structure as the "thought expressed by the sentence," as including the expression as well as the meaning. We shall have to investigate whether this is similarly appropriate for grounding operators. In order to allow semantic structures to enter the language as values for hyperintensional operators, he introduces an opacity operator, θ , that makes an expression out of a non-linguistic entity. Finally, Bigelow uses λ -binding in order to account for quantification into hyperintensional contexts. With these preliminaries, we can present Bigelow's formal system:

First, define a class D of semantic domains, consisting of basic domains, D_0

and D_1 , as well as derived domains. D_0 is the set of sentence intensions; D_1 the set of possible values for names or variables. $D_0 \in D$ and $D_1 \in D$ and, for any domains, $D_\tau, D_{\sigma_1}, \dots, D_{\sigma_n} \in D$, D contains a set $D_{\langle \tau, \sigma_1, \dots, \sigma_n \rangle}$ of partial functions from $D_{\sigma_1}, \dots, D_{\sigma_n}$ into D_τ . Any entity in any domain is a *value*. We can now define a function, μ , that assigns a marker, $\mu(d)$, to each value d . Two clauses determine the behavior of this function. First, for any domain, D_σ , if $d \in D_\sigma$, then $\mu(d) \in D_1$. To ensure uniqueness of the markers, we require that for any $d \in D_\sigma$ and $d' \in D_\sigma$, $\mu(d) = \mu(d')$ iff $d = d'$. For these definitions to be fulfilled, D_1 must be sufficiently large and the other domains sufficiently small.¹³ In addition, he stipulates that any sequence of items picked out from D_1 will itself be a member of D_1 . Finally, all semantic domains are disjoint.

The vocabulary of our language will consist of the following: a function, F , taking each domain D_σ as an argument and assigning to it a finite set, F_σ , of symbols that will be the constants of category σ ; a function, X , taking as argument each domain D_σ and assigning to it a countable set X_σ of symbols called the variables of a syntactic category σ ; the abstraction operator λ ; and an opacity operator θ . We will give formation rules for expressions. First, we say that the base cases of names and variables belong among the expressions; then we specify that the expression that results from concatenating finitely many expressions of appropriate type is itself an expression; finally, we provide rules for the formation of expressions with our abstractions and opacity operators.

The function E assigns to each domain D_σ a set E_σ of expressions of category σ . Let E_σ be the smallest collection meeting the following conditions (122):

- (E1) $F_\sigma \subseteq E_\sigma$ and $X_\sigma \subseteq E_\sigma$.
- (E2) If $\alpha_1, \dots, \alpha_n \in E_{\sigma_1}, \dots, E_{\sigma_n}$, respectively, and $\delta \in E_{\langle \tau, \sigma_1, \dots, \sigma_n \rangle}$, then $\langle \delta, \alpha_1, \dots, \alpha_n \rangle \in E_\tau$.
- (E3) If $x \in X_\sigma$ and $\beta \in E_\tau$, then $\langle \lambda, x, \beta \rangle \in E_{\langle \tau, \sigma \rangle}$.
- (E4) If $d \in D_\sigma$, then $\langle \theta, d \rangle \in E_\sigma$.

The interpretation of a language will be given by a function, V , assigning values to the constants in the language such that if $\alpha \in F_\sigma$, then $V(\alpha) \in D_\sigma$ and

¹³Bigelow provides a sketch of how this might be achieved but does not fill in the details (1978: 121).

a function, v , for variables, such that if $x \in X_\sigma$, then $v(x) \in D_\sigma$. We write the function that differs from v at most in assigning the value d to variable x as $v(d/x)$ so that $v(d/x)(x) = d$ and for all y such that $y \neq x$, $v(d/x)(y) = v(y)$. We can use the functions V and v to define a new function V_v of values for each expression and a function M_v assigning semantic structures to each expression. Here are Bigelow's six clauses specifying the conditions for these two functions (123–124):

- (V1) If $d \in D_\sigma$ and for every syntactic category E_σ , $d \notin E_\sigma$, then $M_v(d) = V_v(d) = d$.
- (V2) If $\alpha \in F_\sigma$, then $V_v(\alpha) = V(\alpha)$ and $M_v(\alpha) = \langle \alpha, \mu(V(\alpha)) \rangle$.
- (V3) If $x \in X_\sigma$, then $V_v(x) = v(x)$ and $M_v(x) = \mu(v(x))$.
- (V4) If $\alpha \in \langle \delta, \alpha_1, \dots, \alpha_n \rangle$, where $\alpha_1, \dots, \alpha_n \in E_{\sigma_1}, \dots, E_{\sigma_n}$, respectively, and $\delta \in E_{\langle \tau, \sigma_1, \dots, \sigma_n \rangle}$, then $V_v(\alpha) = V_v(\delta)(V_v(\alpha_1), \dots, V_v(\alpha_n))$ and $M_v(\alpha) = \langle M_v(\delta), M_v(\alpha_1), \dots, M_v(\alpha_n) \rangle$.
- (V5) If $\alpha = \langle \lambda, x, \beta \rangle$, where $x \in X_\sigma$ and $\beta \in E_\tau$, then $V_v(\alpha)$ and $M_v(\alpha)$ are the functions such that, for any argument $d \in D_\sigma$, $V_v(\alpha)(d) = V_{v(d/x)}(\beta)$ and $M_v(\alpha)(d) = M_{v(d/x)}(\beta)$.
- (V6) If $\alpha = \langle \theta, \beta \rangle$, where $\beta \in D_\sigma$, then $V_v(\alpha) = M_v(\beta)$ and $M(\alpha) = \mu(M_v(\beta))$.

The first clause stipulates that if an object is not an expression, then it is its own value and meaning. The second assigns the value of $V_v = V$ for names. The semantic structure of a name is the ordered pair consisting of the expression itself and the semantic marker of its value. The third clause says that for variables, $V_v = v$ and that the semantic structure is the marker of $v(x)$. Clause 4 provides the compositional conditions; clause 5 gives values and meanings of λ -expressions; and clause 6 specifies that the value of an expression formed by attaching the opacity operator to a non-linguistic item is the semantic structure of the embedded item and the meaning of the whole expression is the semantic marker of its embedded item.

To see how Bigelow's semantics operates, let's consider a simple sentence, derived from an example from Bigelow, that uses the belief-operator, "John believes that David loves Bruce" (125–127). Let us call the embedded sentence,

β , such that $\beta = \langle David, \langle loves, Bruce \rangle \rangle$. We shall call our whole sentence α and specify its logical form as $\alpha = \langle John, \langle believes, \langle \theta, \beta \rangle \rangle \rangle$. Let us stipulate that *David* and *Bruce* are members of the domain of names, F_1 , and *loves* is an expression within category $F_{\langle (0,1),1 \rangle}$, the category taking expressions of name type to those taking a name and making a sentence. The sentence β is a member of D_1 , so we can form an expression, $\langle \theta, \beta \rangle$. By (V6), the value of this expression will be $M_v(\beta)$, which, by (V4), will consist of the ordered pair of the semantic structures of its constituents. By (V2), the semantic value $M_v(David) = \langle David, \mu(V_v(David)) \rangle$. The value of $\langle loves, Bruce \rangle$ will be $\langle \langle loves, \mu(V_v(loves)) \rangle, \langle Bruce, \mu(V_v(Bruce)) \rangle \rangle$. The value of the argument of our belief-sentence α will then be $\langle \langle David, \mu(V_v(David)) \rangle, \langle \langle loves, \mu(V_v(loves)) \rangle, \langle Bruce, \mu(V_v(Bruce)) \rangle \rangle \rangle$. It will be composed of the expressions used and the semantic markers for the values of the constituents. This semantic structure, of course, will differ from that which would result if, say, Bruce were picked out by a definite description, such as “David Lewis’s tabby cat.”

This method provides an extremely fine-grained approach to defining the in-virtue-of-operator. We can approach this operator as we did the *belief* operator and symbolize $\ulcorner \alpha$ in virtue of $\beta \urcorner$ as $\langle In - virtue - of, \langle \theta, \alpha \rangle, \langle \theta, \beta \rangle \rangle$. *In - virtue - of* $\in F_{\langle 0, \langle 1, 1 \rangle \rangle}$. It will take as arguments the values of $\langle \theta, \alpha \rangle$ and $\langle \theta, \beta \rangle$ and thus will be sensitive not only to the values of its component expressions but also to their manner of symbolization. This, however, might be thought to be overly fine-grained, since replacing expressions with synonyms within grounding contexts will change the arguments. In the next section, I’ll suggest adding an invariance criterion for replacement of synonymous terms.

Since the value of $\langle \theta, \alpha \rangle$ is the semantic structure of α , we will have sufficient fineness of grain to allow $\ulcorner A \wedge A$ in virtue of $A \urcorner$. The value of that complex will depend on the values of $\langle \theta, A \wedge A \rangle$ and $\langle \theta, A \rangle$. These will be non-equivalent, since $M_v(A \wedge A) = \langle \langle \langle And, \mu(V_v(And)) \rangle, \langle \langle A, \mu(V_v(A)) \rangle, \langle A, \mu(V_v(A)) \rangle \rangle \rangle \rangle$, while $M_v(A) = \langle A, \mu(V_v(A)) \rangle$. We thus have items of sufficient grain to preserve standard principles of logical grounding for conjunctions, disjunctions, existential, and universal quantifiers, while preserving irreflexivity, asymmetry, and transitivity. Nevertheless, substitutions of bound variables will not change the semantic structure of an expression, so, for instance, $\exists xFx$ will have the same semantic structure as $\exists yFy$. Furthermore, we will be able to accommodate cases such as “something is water in virtue of its being H_2O ,” because the se-

semantic structure of the embedded sentences will differ. Bigelow's neo-Fregean approach thus delivers as formally satisfactory a frame as that provided by structured propositions.

Nevertheless, it might seem like a cheat. After all, we've used a quasi-notational trick of including expressions as elements within a semantic tree. Surely, we've achieved fineness of grain at the expense of the distinctive feature of grounding: its being *about the world*. If we're to go down this route, we might as well just have said that grounding is a relation among linguistic constituents. In the next section, I'll briefly consider this objection. I'll argue that there are really several distinct concerns behind the objection, some of which present real problems for the approach and others of which don't.

§4. Objections to the Tree Approach to Grounding

Objection: How can grounding claims be about the world when the *in-virtue-of* operator is sensitive to the expressions used in the statement of the arguments?

Response: It's not entirely clear that the feature is pernicious. First, just because a grounding statement contains representational constituents certainly doesn't mean it isn't solely *about* worldly matters in the intuitive sense in which propositions are typically about some matter of fact. We can contrast that to canonical belief statements like 'Mary believes Mont Blanc is a beautiful mountain', which is intuitively partially about mental states.

But does our semantics make it unduly mind dependent? To help in answering this, we can distinguish between what the truth-value of a grounding statement depends on and what the constituents of the content of the claim are. A claim is weakly worldly, in the sense introduced earlier, just in case the truth value of the claim in any situation does not depend on features of mind or representation. This is compatible with including representational items within the content as long as the truth-value of the claim in any situation does not depend on them. Bigelow's approach would not satisfy the strong worldly constraint of including only non-representational items among the constituents, but why should this matter as long as the truth-value of the grounding claim does not depend on these representational constituents? If grounding claims are weakly worldly, then their representational elements should be harmless. But why think grounding claims are weakly worldly?

Much depends, of course, on what we consider a representational or mental feature. We can form different disambiguations of a weak worldliness criterion based on different dependence relations. There are two plausible ways of cashing out weak worldliness in Bigelow’s system. First, we might say that a theory is *worldly*₁ iff, for any statement of the theory, substitution of expressive invariants yields a statement true in just the same models as the original statement, where two closed well-formed expressions, α and β , are *expressive invariants* iff there is a derivation of each from the other by replacement of expressions by expressions with the same semantic value. Presumably, sets of beliefs would frequently fail to be worldly in this sense, at least if Lois Lane can believe Superman is Superman without believing Superman is Clark Kent. It is not entirely clear whether grounding does satisfy this: consider the case introduced earlier of two simple properties, E and M , that are necessarily co-extensive. If there are such necessary connections between simple properties, then, even if they have two different names, the framework will assign them the same semantic values, and they will only differ in expression. Whether or not grounding is *worldly*₁ depends, then, on whether there are such simple intensional equivalents. But notice what’s going on here: grounding fails to be *worldly*₁ because our grounding theorist holds that there’s a difference between two simple properties that is hyperintensional. So this theorist shouldn’t care about whether grounding satisfies this criterion.

Second, we might define a notion of worldliness, *worldly*₂, that more closely tracks Church’s idea of synonymous isomorphism. To do so, we will first modify Church’s definition to fit our semantic structure framework. Intuitively, an expression is invariant under synonymous isomorphism just in case replacing what occurs at a node n within the expression’s parse tree with a synonymous expression yields a new parse tree with equivalent meaning. More precisely:

Def. An expression α of type i is invariant under synonymous isomorphism iff: If A is the parse tree of α , then for any node n of A , the mapping $A \mapsto A^*$ generated by replacing the item occurring at n with a synonymous item yields a parse tree A^* which is meaning-equivalent to A .

Ordinary sentences like “Bruce loves David” will come out as invariant under synonymous isomorphism, because replacing the content of any node with an

item of equivalent meaning will yield an equivalent semantic structure. But belief statements will not turn out to be invariant under synonymous isomorphism. Take a case like “Lois Lane believes Superman is Superman.” If we replace the first instance of ‘Superman’ with ‘Clark Kent’, then, because the belief-operator is sensitive to the *meanings* of its arguments, the meaning of the entire sentence will differ. This is the result we want. How does it work in the case of the *in-virtue-of* operator?

I suggest that we add the requirement that *in-virtue-of* be invariant under synonymous isomorphism: if the value of $\ulcorner \alpha \text{ in virtue of } \beta \urcorner$ were altered by such transformations, then it would not seem that there was any sense in which it was worldly. It isn’t plausible to think that grounding claims could differ through replacement of simple expressions with those of the same meaning. For instance, if it’s the case that this color sample is brown in virtue of being taupe, then it will be the case that this color sample is brown in virtue of its being khaki. This contrasts with the case of belief and other intentional attitudes, where the truth value is sensitive to replacement of synonyms. After all, it is at least plausible that a suitably confused reader of a color sample book might believe the sample is taupe without believing its khaki. A properly formulated synonymy criterion can thus distinguish between grounding and cases of intentional attitudes. Now consider a more complicated case such as “John believes this is brown in virtue of John’s belief that this is taupe.” Here, it might seem that this fails the test for synonymous invariance, since replacing ‘taupe’ with ‘khaki’ changes the meaning of the whole statement. But this would be an incorrect application of the criterion: notice that even though ‘taupe’ and ‘khaki’ are by stipulation synonymous, ‘John believes this is taupe’ is not synonymous with ‘John believes this is khaki,’ so the new parse tree will not be equivalent in meaning.

Now, we can define a theory as *worldly*₂ iff, for any statement of the theory, substitution by synonymous isomorphism yields a statement true in just the same models as the original statement. With the additional stipulation that *in-virtue-of* is to be invariant under substitution by synonymous isomorphism, we have the result that grounding is *weakly worldly*₂.

Of course, this is to pack quite a lot into the idea of synonymy. If synonymous expressions are those that have just the same cognitive significance in the broadest sense, then one might doubt there are synonyms at all—after all

the connotations of each word vary.¹⁴ This risks trivializing the sense in which grounding is worldly. But there seems to be some hope that a more informative criterion can be found that broadly corresponds to having-the-same-Fregean concept: perhaps including cross-linguistic cases. Thus far, I have considered only single-word replacements as candidates for synonymy, but there is nothing in the framework that restricts synonymy to cases in which a term *a* is replaced by a synonymous term *b*. For instance, if we take active-passive transforms to have the same cognitive significance, then we can broaden our conception to include sentence synonymy and say that grounding facts are sentence-synonym invariant.¹⁵ Similar maneuvers might be performed to deal with shifts in what a sentence is intuitively “about” arising from focal shifts. Bigelow’s formal framework is malleable enough to deal with such cases, and our decision about whether or not to countenance these transformations will depend on our assessment of whether they have the right sort of sameness of cognitive significance.¹⁶ Framed in this way a synonymy criterion might be capable of dis-

¹⁴Kripke (1979) has pointed out that puzzles of substitutivity of names in belief contexts do not tell decisively in favor of a Fregean picture of names. Similar puzzles arise in the case of substitutions of synonymous simple expressions at stake here. After all, one might want to maintain that there is a good sense in which we can report on beliefs in other languages, so there must be at least some coarse-grained notion of belief that is translation-invariant. The issues here are thorny and have generated a large literature [...]. I think the right response to these concerns is to allow for varieties of grain, so that certain contexts pick out beliefs under a mode of presentation while others prescind from such modes. The details of this will be tricky, but I think there is at least strong motivation for allowing a maximally fine-grained notion of the contents of belief statements to allow us to account for intuitive differences in truth value between claims such as those mentioned above.

¹⁵Though nothing in the framework commits us to these equivalences. For doubts concerning whether active-passive transforms should be taken to have the same semantic content, see Ziff (1966).

¹⁶My criterion for propositional equivalence is what Correia calls a ‘conceptual’ rather than a ‘factual’ conception of grounding (2010). According to Correia, ‘factual’ conceptions of grounding are those that take statements that intuitively describe the same states of affairs to be equivalent in grounding concepts, while ‘conceptual’ notions say that any two statements that have different cognitive content are not grounding equivalent. In my view, this draws the distinction between wordliness and non-worldiness in a question-begging fashion. It seems to me highly contestable that, for instance, “This is water” and “This is H₂O”—Correia’s favorite example of a merely conceptual difference—do not express different facts. Typically, the proponent of factual grounding (e.g. Audi (2012)) will claim that *p* and $\neg\neg p$ are grounding equivalent, while proponents of conceptual grounding (e.g. Rosen (2010)) will typically claim that any formulas with different logical connectives will fail to be grounding equivalent. Correia develops an axiomatic system for his preferred notion of factual equivalence based on Roger Angell’s system of analytic equivalence and shows the soundness and completeness of his system against a proposed semantics. Since my Lewisian approach takes meanings to be determined by trees and since two sentences will have different trees if they have different logical

tinguishing the worldliness of grounding from intentional attitudes like belief, since belief statements are not simply subject to shifts in this sort of cognitive significance but to additional linguistic and other criteria.

But, our objector might say, this misses the point: the problem is not just finding some criterion for distinguishing grounding from intentional attitudes like belief. The problem is that any approach that leans on the way in which semantic values are produced has to do with how we represent things rather than how things are in the world. This objection thus pertains to any broadly neo-Fregean approach to the semantics of grounding claims. After all, we started with the problem of how grounding claims could be responsive to genuine worldly structure if our only ontological building blocks are possibilities, and we have ended with an account that builds up the structure of grounding claims from the manner in which semantic values are constituted. But semantic values have to do with how we represent things rather than with what is in the world.

I think that it's important to distinguish here between what entities a theory is committed to and what is 'worldly' according to the theory. Grounding claims, on this account, are sensitive to semantic structure because this semantic structure is thought to reflect something about the dependence relations within the world. Even though functions are not among our first-order ontological resources, they are nevertheless mind and representation independent. In this sense, the neo-Fregean approach is no less worldly than a neo-Russellian strategy that likewise takes our linguistic structure as a guide to worldly structure. In fact, we might think that the neo-Fregean has an advantage here, in that her compositional account is committed only to functions that behave compositionally rather than to a particular ontological story. The neo-Russellian builds up her propositions out of particular types of entities to which she is committed, such as objects and properties. The 'General Semantics' approach, by contrast, can remain neutral about what the basis for differing structures consists in: her framework is compatible with many ontological stories as long as there is room in the picture for functions. The approach thus does not answer the metaphysical question of the nature of hyperintensional worldly structure but it does promise a framework in which principles of grounding can be formulated.

connectives, p and $\neg\neg p$ will not be grounding equivalent.

§5. Conclusion

Above, I have sketched how the framework of ‘General Semantics’ can be adopted to provide a semantics of an *in-virtue-of* operator and argued that this satisfies two senses in which grounding can be thought to be worldly: it is *about* worldly matters and it can be made invariant to replacements of synonyms. I have not, however, provided principles specifying when two formulas within grounding statements should be considered *grounding equivalent*, that is, when replacement of one formula by another within a grounding claim does not change the truth value of the whole grounding claim. For instance, I have said nothing about whether replacement of a formula $p \vee q$ in r *in virtue of* $(p \vee q)$ by its de Morgan equivalent $\neg(\neg p \wedge \neg q)$ yields an equivalent grounding claim. Listing such principles is an important part of the task of a theory of grounding, but the framework I have provided suggests a recipe for including one’s preferred principles of grounding: we define a class of parse tree mappings—as was done for the synonymy criterion—that will yield the desired set of grounding equivalences. Formulas will then be invariant to substitutions by any member of the selected class of mappings: if one thinks grounds are invariant to de Morgan’s transformations, then the suggested equivalence mapping will hold.

The framework is thus flexible enough to suit different theories of grounding. For example, if one does not think there are any simple, necessarily equivalent properties, then one can say that the class of mappings that preserve tree structure and semantic value of the nodes will be grounding equivalent, but if one does think there are such properties, then one will specify a more restrictive class of mappings. This represents a decisive advantage over a Neo-Russellian theory, which has difficulty accounting for necessarily coextensive but distinct simple properties. Thus, the Neo-Russellian is committed, merely in virtue of her semantic theory, to substantial claims about grounding, while the ‘General Semantics’ approach can remain neutral on this. Moreover, the proposed framework integrates grounding claims into a general, theoretically tractable, account of the semantics of intentional attitudes and thus offers the prospect of a unified linguistic account, rather than proceeding piecemeal.

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