How to Think About Stuff:
Logic and Semantics for Non-Count Nouns

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Abstract

In English and many similar languages, nominal expressions fall into two basic morphosyntactic categories: "chair," "raindrops," and "my brother's library books" are paradigmatically *count*, while "furniture," "water," and "the cheese in this box" are paradigmatically *mass* or *non-count*. Previous treatments characterize non-count expressions as referring to sets, mereological sums, or simple individuals, using standard predicate logic or plural logic as a basic framework. All these approaches take language containing non-count expressions to represent a special case of (singular or plural) reasoning about things, to which it must ultimately be reduced. In this paper, I argue that non-count expressions instead represent a distinct third kind of reasoning—namely, reasoning that proceeds in terms of "stuff" without referring to, or committing to the existence of, any specific thing or things. Building on this idea, I then present a novel semantics on which a non-count expression K refers to the contents of some time-space region that is non-empty in a K-way, and show how this system accounts for sentences that have generated problems for previous treatments while remaining neutral about the existence of K-sets, K-sums, and simple K-things.[1]

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1 Introduction

Sometimes, we talk about a single thing:

(1) The chair is in good condition.

(2) My bougainvillea has grown very large.

(3) This ice cube fell on the floor.

Sometimes, we talk about several things:

(4) The tables are in the garden.

(5) These people finished the race.

(6) He walked four dogs at once.

And sometimes we talk about stuff:

(7) The furniture is heavy.

(8) Her drink is half tea and half lemonade.

(9) This water has been in my basement since last week.

Intuitively, thing-talk, things-talk, and stuff-talk seem to differ from one another in some important respect(s). Two possible characterizations readily suggest themselves.[2] First, these differences might be ontic/ontological, having to do with the (kinds of) entities in the world to which we refer, independent of our manner of referring. A second possibility is that these differences might be linguistic/logical, relating to the manner of reference and reasoning we employ in engaging with the world without implying anything about the world's actual content or structure. Prevailing accounts have characterized the differences between thing-talk, things-talk, and stuff-talk as ontic/ontological. In this paper, I argue that the differences between thing(s)-talk and stuff-talk are linguistic/logical, and I develop an account of stuff-talk as a distinct mode of reasoning that permits a greater degree of ontological neutrality

[2]These possibilities represent opposite ends of a spectrum. For clarity's sake—and because most previous accounts, as well as the one presented here, fall on one or the other extreme—I first characterize the paradigm approaches and introduce additional qualifications as necessary.

than do thing- and things-talk.[3]

We can clarify the differences between the ontic/ontological approach and the linguistic/logical approach by articulating two opposing conceptions of logic and the normative force it exerts on our reasoning. *Logical monism*, first, is a family of views on which there is in some sense a single "real" or "correct" logic that uniquely represents right reasoning, and it is logicians' job to identify or construct that logic. *Logical pluralism*, by contrast, is a family of views on which there are in some sense multiple "real" or "correct" logics, representing different modes of reasoning that are (more or less) incommensurably "right." We may, following Eklund (2012, p. 217), make this broad division more precise by distinguishing between two kinds of "which is the right logic?" question. *Vertical* questions, on the one hand, concern the scope of logic, asking whether some particular logic (e.g., modal, plural, or second-order logic) counts as "real logic"—asking, that is, which properties are essential to "logic" in general and whether some particular logic exemplifies these properties. *Horizontal* questions, on the other hand, concern which of various rival logics is the uniquely correct one (e.g., should we recognize classical or paraconsistent or intuistionistic logic, etc.?). In other words, there are two independent ways to be a logical pluralist: one might be a vertical pluralist, allowing different kinds of logic to account for different kinds of expressions (tenses, modals, etc.) while potentially maintaining that each logic is uniquely representative of valid reasoning relative to its share of the overall terrain, and/or one might be a horizontal pluralist, allowing for different logics to independently account for the same terrain (e.g., we might recognize different senses of logical consequence). Both vertical and horizontal logical monism/pluralism are *terrain-relative* rather than *logical language-relative*: whether a given logic counts as (vertical/horizontal) monism or (vertical/horizontal) pluralism on a given account depends on that logic's relationship to the given terrain on that account, not on some

[3]Laycock (2006) was a formative influence in the early stages of this project.

intrinsic feature(s) of the logic itself.

Our opening question about the differences between thing-talk, things-talk, and stuff-talk—three subregions jointly comprising the nominal terrain—is a vertical inquiry. Someone who characterizes these differences as exclusively ontic/ontological would recognize just one logic that accounts for all three kinds of expression and would thus be a vertical logical monist with respect to the nominal terrain, while someone who characterizes these differences as exclusively linguistic/logical would divide the nominal terrain into three parts that each correspond to a distinct logic, thus being a vertical logical pluralist with respect to the nominal terrain. The issue at stake is the division of explanatory labor: given that thing-talk, things-talk, and stuff-talk are somehow meaningfully different, we must determine the respective degrees to which our ontology and our logic should account for these differences.[4]

What factors determine how to correctly divide the explanatory labor in a case like this? Bracketing the more exotic issues that arise in horizontal inquiries (truth-value gaps and the like), there are two canonical features that a logical language must satisfy in order to count as "real logic," in the vertical sense noted above—that is, these two features constitute what logicians mean by "logic" as such. To speak generally, "logic" comprehensively and correctly represents valid patterns of reasoning for its given terrain. To satisfy this requirement, a particular logic must first be what Ryle (1954) calls "topic-neutral": its valid inferences must be valid for all applications and likewise for its invalid ones; that is, validity must depend solely on form. Second, the logic must minimize its built-in ontological commitments, aiming for perfect ontological innocence. These two factors suggest a straightforward method for deciding between proposed divisions of labor between ontology and logic. Given a terrain for which we want to specify how valid reasoning works (e.g., modality), we should seek a logic that is able to account for everything in that terrain without

[4]To be clear, I am not here attempting to answer any explanatory questions; rather, I am arguing that these questions should be addressed independently of logic.

paradox—thus satisfying the topic-neutrality requirement—while requiring the fewest ontological commitments. If a given logic fails to be topic-neutral or requires more ontological commitments than some comparable logic, we should discard it. Applying this method to our question about thing-talk, things-talk, and stuff-talk, we need simply compare the topic-neutrality of, and ontological commitments required by, each account of the differences between thing-talk, things-talk, and stuff-talk (i.e., each proposed division of the explanatory labor) and choose the account that fares best according to the standards of topic-neutrality and ontological parsimony.

This task has already been partially completed in the course of work on the nature of plurals (see Rayo (2002) and Oliver & Smiley (2013)). For most of the twentieth century, the default approach to plural expressions was *singularist*—an instance of vertical logical monism with respect to the singular-and-plural-nominals terrain—which analyzes plural expressions as singular terms that refer to compound individuals like sets or mereological sums. On this approach, sentences (4), (5), and (6) above would respectively refer to sets or sums of tables, people, and dogs. In response to serious failures of topic-neutrality and ontological parsimony, however, more recent work has produced an alternative approach—an instance of vertical logical pluralism with respect to the singular-and-plural-nominals terrain—that does not require as a matter of logic that all plural expressions be reduced to singular ones. Rather, this approach recognizes singular and plural reference as equally legitimate; it interprets plural expressions as plurally referring to some number of individual things without asserting the existence of those objects' set or sum. On this view, (4), (5), and (6) would plurally refer to several tables, people, and dogs, respectively, while remaining neutral as regards the existence of sets or sums of tables, people, and dogs.

What about sentences like (7)-(9), which I have called "stuff-talk"? As these sentences show, singular and plural do not exhaust the morphosyntactic range of English nominal expressions. There is also a higher-level distinction between *count* expres-

sions as in (1)-(6), which may be either singular or plural and which apparently refer to some individual object(s), and *mass* or *non-count* expressions as in (7)-(9), which are invariable in grammatical number and apparently refer to aggregates or masses of various kinds.[5] Non-count reference is often cumulative and distributive, while count reference is neither. For instance, combining two instances of water leaves you with one bigger instance of water and halving a (non-microscopic) instance of water leaves you with two smaller instances of water, but the same cannot be said for lamps or giraffes.

Previous accounts have characterized a non-count expression K either as singularly referring to compound K-things (sets and/or sums), or in one recent case, as plurally referring to some simple K-things. These approaches are instances of vertical logical monism relative to the count-and-non-count-nominals terrain because they analyze both count and non-count expressions within a single logical framework (singular or plural logic, as the case may be). However, as I will show, each of these approaches fails to be topic-neutral and ontologically parsimonious, so we should seek an account that better meets these standards.

In this paper I develop such an account, an instance of vertical logical pluralism with respect to the count-and-non-count-nominals terrain: I devise a semantics and logic containing non-count terms and predicates to be employed alongside existing singular and plural systems. Previous accounts characterize non-count expressions as referring to—and thus natural language speakers using them as committed to the existence of—at least one "thing," an entity that is *countable as one* and so has some (more or less weak) kind of essential metaphysical unity. By contrast, I characterize non-count expressions as feature-placing terms (Strawson's (1959) phrase) that designate the contents of time-space regions; to assert that "there exists some K" is

[5] I take so-called abstract non-count expressions like "cowardice" to be figurative in that we use them to talk as if *cowardice* etc. are substances when in fact they are not, just as we use count expressions like "fear(s)" as if they refer to actual discrete objects when this is not so.

simply to assert that some region is non-empty in a K-way, while remaining neutral about the existence, or lack thereof, of things in that region. I also equip my logic with a weak analogue of part-whole relations that accounts for our intuitive notion of smaller stuff-portions existing within bigger stuff-portions, adapting the inclusion operator from plural logic to avoid implying the existence of the wholes as metaphysically unified things (as conventional mereological systems do).

We may prevent some possible confusions by briefly discussing the senses in which this project is and isn't "descriptive." Since my goal is to account for reasoning involving a specific class of natural language expressions, I must attend to their conventional meanings and intuitive truth-conditions; at the same time, because my end product is a logic rather than a survey of natural language, I will not hesitate to make generalizations of the kind we routinely do in translating English sentences into standard predicate logic. More importantly, one should not mistake my talk of "stuff" for talk of a distinct ontological category and then object that we know the so-called stuff in question to actually consist of particles. I do not intend the word "stuff" to pick out some distinct ontological category; rather, I use "stuff" in a deflationary sense, as a label for a way of thinking and talking that is compatible with atomless gunk, simple individuals, sets, mereological sums, and any other categories we might consider. Non-count logic is thus descriptive insofar as it captures one valid mode of reasoning we have at our disposal without trying to settle any ontic/ontological questions.

One other explanatory note is in order. Some accounts of non-count expressions seem to concern themselves solely with semantics, while others begin by talking about logic. This situation is symptomatic of the deeper differences between various approaches. Roughly, those who characterize the differences between thing(s)-talk and stuff-talk as ontic/ontological—vertical logical monists—achieve their non-count semantics by redirecting preexisting logical equipment at different ontological categories, while those who characterize the differences between thing(s)-talk and

stuff-talk as (more) linguistic/logical—vertical logical pluralists—first introduce new logical equipment and then use it to build a semantics. That is, a logical framework is required for any semantics of non-count expressions; some accounts implicitly rely on standard predicate logic, while others explicitly choose a different logical framework.

Below, §2 gives a brief overview of those treatments of non-count expressions which use set theory and/or mereology, enumerating their attendant difficulties; §3 outlines plural logic, and then considers and rejects the one treatment of non-count expressions that uses plural logic instead of singular logic. Finally, §4 presents my own treatment of non-count expressions and shows how this account avoids the problems encountered by the other approaches.

2 Previous Treatments I: Singular Logic

All but one previously published account characterize non-count expressions as singularly referring to compound things: sets, sums, or a combination thereof. Each of these approaches is prone to major difficulties, which are well-documented in the literature (with one exception, noted below). This section briefly outlines each strategy and its respective problems. For more in-depth discussion, see Pelletier & Schubert (1989) and Nicolas (2008, 2016).

2.1 Set-Theoretic Approaches

One popular strategy—as in, for instance, Burge (1972), Grandy (1973) and Montague (1973)—treats a non-count expression M as referring to a set of M-things. Specifying what these M-things are poses a significant difficulty, however. Consider the following sentences:

(10) This is cheese.

(11) The gravel in the truck weighs 250 pounds.

(12) I shaped the heap of clay that was on the table before into the two cubes there now.

(13) All phosphorous is red or black.

Here (10) is true iff *this* (what is demonstrated) is a member of the set of things that can be said to be cheese (i.e., iff [*this*] $\in$ {cheese-thing$_1$, cheese-thing$_2$, ... cheese-thing$_i$}). So far, so good. We encounter a first problem in (11), however, which is true iff the set of things that can be said to be gravel-in-the-truck weighs 250 pounds. On the set-theoretic view, there would be many overlapping things that count as gravel-in-the-truck (e.g., piece A, piece B, and A and B taken together), and so summing the weights of the members of the gravel-in-the-truck set would yield a grossly inflated result (Bunt 1985, pp. 41-42). Sentence (12) illustrates a second problem, developed by Nicolas (2008). Intuitively, "the heap of clay" and "the two cubes" in this sentence refer to the same clay differently arranged, but the only way to make this come out true on the set-theoretic approach would be to analyze both expressions as referring to the set containing only the "minimal parts" of clay—the smallest bits of clay-stuff that still count as clay—and not any of the bigger pieces. However, this strategy will not work in all cases because it is not clear for many non-count expressions (e.g., mud, lemonade) what the minimal parts would be; furthermore, this would require that we exclude the possibility of atomless gunk *a priori*. A third problem emerges in (13), if we consider a piece of phosphorous which is partly red and partly black: since it is the case that all phosphorous is either red or black, but not the case that all *pieces* of phosphorous are exclusively red or black, such a piece would belong to the set of things that are phosphorous but not to the set of things that are exclusively red or black (Roeper 1985).

There is one final problem, generally unremarked in the literature on non-count expressions. In a pioneering paper on plural logic, Boolos (1984, pp. 448-449) writes:

> Entities are not to be multiplied beyond necessity. One might doubt, for example, that there is such a thing as the set of Cheerios in [a] bowl on the table. There are, of course, quite a lot of Cheerios in that bowl, well over two hundred

> of them. But is there, in addition to the Cheerios, also a set of them all? And what about the > 1060 subsets of that set? (And don't forget the sets of sets of Cheerios in the bowl.) It is haywire to think that when you have some Cheerios, you are eating a set—what you're doing is: eating THE CHEERIOS. ... [I]t doesn't follow just from the fact that there are some Cheerios in the bowl that, as some who theorize about the semantics of plurals would have it, there is also a set of them all.

This objection applies *mutatis mutandis* to any account that analyzes non-count expressions as referring to sets. One might think that sets are simply not the kind of thing that one drinks (THE COFFEE), gets smeared across one's shirt (THE MUD), or stores in a cabinet for safekeeping (THE CHINA). But suppose we could supply a plausible account on which sets are non-abstract objects; the real issue is that set-theoretic analyses of non-count expressions would still commit us to the existence of infinitely many sets as a matter of logic. We might have excellent independent reasons for supposing that these sets exist, but our stated goal of ontological parsimony dictates that our *logic* should not commit us to the existence of any additional entities if this can be avoided. For this reason as well as those mentioned above, then, purely set-theoretic treatments of non-count expressions leave room for improvement.

2.2 Mereological Approaches

As an alternative to set-theoretic approaches, a number of authors (e.g., Moravcsik (1973), Link (1983), Bunt (1985), Lønning (1987), Higginbotham (1994)) treat a non-count expression M as referring to (part of) a mereological sum of M; sentences like (10), for instance, are true iff the sum of what is demonstrated is a part of the sum of all cheese in the domain. The mereological approach can handle sentences like (11)-(13), but fails for sentences like

(10) This is <u>cheese</u>.

because the sum of all the cheese in the domain has parts that are not themselves cheese (e.g., sub-atomic particles). Sentences like

(14) All this furniture is made of wood,

introduce another problem (Parsons 1970) because they identify the sum of all the domain's furniture with the sum of all the domain's wood, resulting in counter-intuitive truth behavior with predicates like "came from Pennsylvania" or "cost a lot of money," which might be true of only the wood or only the furniture. Although one might avoid both this and the preceding issue by associating kind-specific part relations with each non-count expression (i.e., $[this] \leq_M [M]$), this variant fails to account for intuitively valid syllogisms that require transitivity, such as

(15) This box is oak, and oak is wood, so this box is wood.

On the M-parts variant, (15) would be analyzed as

(16) $[\textit{this box}] \leq_{oak} [OAK]$ & $[\textit{oak-things}] \leq_{wood} [WOOD] \rightarrow [\textit{this box}] \leq_{wood} [WOOD]$,

which is invalid. Thus, neither variant of the mereological approach is satisfactory.

Nicolas (2008, 2016) points out an additional problem for mereological approaches. Non-singular sentences may accept both collective and non-collective construals, as in

(17) These animals transported that equipment

which might, depending on context, mean that all the animals together moved a single piece of equipment, or that the animals each carried different pieces of equipment, etc. In general, our analysis must account not only for the sums denoted by non-count expressions, but also for the different ways the parts of these sums might be arranged with respect to one another. Mereology does not provide sufficient expressive power to accomplish this; sets or something equally powerful are required as well.[6]

Finally, it is worth observing that the CHEERIOS objection also applies to the mereological approach: we are committed not only to the existence of the pieces of

[6]For instance, Nicolas (2016) uses the notion of a *covering* (adapted from Gillon (1992)), which he defines as follows: A set X is a covering of set Y iff the mereological sum of the elements of X is identical with the mereological sum of the elements of Y.

furniture (say) but also to the sum of them all, and while such a sum may in fact exist, we should not be committed to it simply as a matter of logic.

2.3 The Hybrid Approach

Nicolas (2016) describes a hybrid approach on which non-count predication is understood in terms of set membership and non-count subjects refer to sets containing as their only member the join semi-lattice generated by summing portions of M:

(18) *This is M* is true iff: [this] $\subseteq$ [M-sum]

(19) *Some M P* is true iff: [M-sum] $\cap$ [P] $\neq \emptyset$

(20) *The M (that Q) P* is true iff: [the M (that Q)] $\subseteq$ [P]

Nicolas (2016) identifies a problem with this idea, however: it fails to properly account for negation. Consider his examples:

(21) The gold is in the safe

(22) The gold is *not* in the safe

where we suppose the domain consists of two pieces of gold, a and b, and their join, $\{a \vee b\}$. Then, on the hybrid analysis, $[gold] = \{a, b, a \vee b\}$, $[the\ gold] = \{a \vee b\}$, and $[in\ the\ safe] = \{a\}$. So (21) is true just in case $[the\ gold] \subseteq [in\ the\ safe]$, and it comes out false on the stipulated scenario. Now it seems plausible that *The M not P* should be true just in case *The M P* is false, and this would predict that (22) is true on the stipulated scenario. This is a problem because, given that [*the gold*] is neither fully in or nor fully outside of the safe, neither (21) nor (22) should be true.

Finally, the CHEERIOS objection applies just as much to the hybrid account as it does to purely set-theoretic and mereological accounts. Since every non-count expression refers to a set on the hybrid account, we are still committed to the existence of infinitely many sets and mereological sums as a matter of logic—something to avoid if possible.

3 Previous Treatments II: Plural Logic

We have seen how the standard approaches to the semantics of non-count expressions interpret them within predicate logic as singularly referring to compound objects, whether sets, sums, or both together. We have also seen how these approaches fail to be topic-neutral and ontologically innocent. Nicolas (2008) presents an innovative treatment of non-count expressions using plural logic, on which non-count expressions plurally refer to one or more simple things of the appropriate kind. Although this approach avoids the problems characteristic of the standard approaches, I will argue that it too fails to be topic-neutral and ontologically innocent. In order to do so, I must discuss Nicolas' view in some detail. I therefore begin with a thumbnail sketch of plural logic in §3.1, present Nicolas' account in §3.2, and outline the problems with Nicolas' account in §3.3.

3.1 Summary of Plural Logic

Linnebo (2008), McKay (2006), Oliver & Smiley (2013), Rayo (2002, 2006), and Yi (2005, 2006) have all made significant contributions to plural logic. Rather than getting bogged down in the finer points of these accounts, I here present the core elements of plural logic in modest detail; where there is a dispute in the literature, I follow the principles that Nicolas (2008) uses in his application of plural logic to non-count expressions.

In addition to singular constants (a, b, c, ...) and variables (x, y, z, ...), plural logic includes plural constants (as, bs, cs, ...) and variables (xs, ys, zs, ...) that plurally refer to one or more individuals in the domain of interpretation. Predicates may have multiple argument places, and each argument place may accept singular terms, plural terms, or both. Statements composed of predicates that contain a plural constant are true iff the one-or-more-things to which that constant is interpreted as referring jointly

satisfy the predicate. Quantifiers apply to both singular and plural variables. Plural logic treats the predicate "among"—which I will follow Oliver and Smiley (2013) in signifying as "$\preccurlyeq$"—as a logical predicate alongside identity. It is defined as follows (sans initial quantifiers):

(23) $y\text{s} \preccurlyeq z\text{s} \leftrightarrow \forall x\ (x \preccurlyeq y\text{s} \rightarrow x \preccurlyeq z\text{s})$
One-or-more-things ys are among one-or-more-things zs iff any thing x that is among the ys is also among the zs.

The metalanguage for plural logic itself uses plural terms, and the domain is fixed by one or more individuals, rather than the set of those individuals as in standard predicate logic. Predicates present something of a problem. Some authors let them refer directly to worldly properties and relations. However, in order to allow for absolutely unrestricted quantification and avoid Russelian paradoxes, Nicolas follows Rayo (2006) in adding *superplural* terms ($x$ss, $y$ss, $z$ss, ...) that refer to one or more so-called "pluralities" (understood in a deflationary sense, as carrying no ontological weight). Plural predicates then apply to the one-or-more-"pluralities" to which superplural terms refer.

3.2 The Plural View of Non-Count Expressions

Capitalizing on the new possibilities afforded by plural logic, Nicolas (2008) devises a semantics that, in his words, "treats [non-count expressions] as non-singular terms, which may refer to several things at once" (p. 232). It will be helpful to begin with an example. Suppose we have some wine in a punch bowl that includes some frozen wine-cubes:

(24) This wine cost two hundred dollars.

(25) Some of the wine in this bowl is frozen.

(26) The wine in these glasses is the same wine that was in the bowl ten minutes ago.

On Nicolas' account, the wine-expressions in all three sentences refer to all the things

that count as wine in their respective domains; however, in each sentence, one non-overlapping set of wine-things (i.e., one partitioning of the wine) is overridingly salient. In (24), this is the single wine-thing that is all the wine in the bowl; in (25), the set of frozen wine-cubes; in (26), a set of some small bits of wine that each preserve their identity through the transfer from the bowl into the glasses.

Now to generalize. Three principles capture the core of Nicolas' account (paraphrases mine):

(27) $\mathrm{M}x\mathrm{s} \leftrightarrow \forall y\ (y \preccurlyeq x\mathrm{s} \leftrightarrow \mathrm{M}y)$
One-or-more-things are M iff each of them is M.

(28) $\mathrm{DEN}(M,\ d\mathrm{s}) \leftrightarrow \forall y\ (\mathrm{M}y \leftrightarrow y \preccurlyeq d\mathrm{s})$
M denotes the ds iff: all things-that-are-M are among the ds, and nothing else is among the ds.

(29) $\mathrm{DEN}(\textit{The } M \textit{ that } Q\mathrm{s},\ a\mathrm{s}) \leftrightarrow \forall v\ (v \preccurlyeq a\mathrm{s} \leftrightarrow \exists z\mathrm{s}\ (v \preccurlyeq z\mathrm{s} \wedge \mathrm{M}z\mathrm{s} \wedge \mathrm{Q}z\mathrm{s}))$
The M that Qs denotes the as iff: for any thing v, v is among the as iff there exists some one-or-more-things the zs such that v is among the zs and the zs are M and the zs Q.

Nicolas further specifies that "a thing that counts as M must be *self-connected*, of a single piece" (p. 233). For instance, "the greatest portion of wine in a bottle is a thing that counts as wine, [and so] is the greatest portion of wine in the lower half of the bottle," but if we have two bottles of wine, what we have "are two things that count as wine, not a disconnected thing that would count as wine" (p. 234). Nicolas formalizes the overriding-partition phenomenon with a "non-singularist notion of covering" (paraphrases from original):

(30) The $c$ss are an M-covering of the as just in case the following three conditions are satisfied:

(i) Any thing among$^\circ$ the $c$ss is M: $y \preccurlyeq^\circ c\mathrm{ss} \rightarrow \mathrm{M}y$

(ii) For any "plurality" of the $c$ss, no two members of the "plurality" overlap: $x\mathrm{s} \preccurlyeq c\mathrm{ss} \rightarrow \neg(\exists u\ \exists v\ (u \preccurlyeq x\mathrm{s} \wedge v \preccurlyeq x\mathrm{s} \wedge u \neq v \wedge \mathrm{O}uv))$

(iii) For anything v, v overlaps some thing among$^\circ$ the $c$ss just in case v overlaps one of the as: $\exists y\ (y \preccurlyeq^\circ c\mathrm{ss} \wedge \mathrm{O}uv) \leftrightarrow \exists w\ (w \preccurlyeq a\mathrm{s} \wedge \mathrm{O}uv)$

More simply, these conditions require that (i) the relevant non-count expression applies to each thing in the covering, (ii) each of the "pluralities" in the covering—each,

that is, of the particular partitionings of the thing being covered—is non-overlapping, and (iii) the *c*ss exactly compose the *a*s, accounting for all the *a*s but not exceeding them.[7] That is, a covering is one possible partitioning of the M in the domain, assigning a d to each part. The different mappings of wine-things onto wine in (24), (25), and (26) are coverings of the wine.

Nicolas offers other interesting schemata—for instance, M-specific correlates of antisymmetry, transitivity, and strong supplementation reinterpreted in plural logic—and an expansive catalogue of truth-conditions for common non-count sentence-types. He specifies the following for sentences like (24) and (25), respectively (paraphrases mine):

(31) *Some M Ps* is true iff: $\exists y\text{s}\ (\text{M}y\text{s} \wedge \text{P}y\text{s})$
There exist one-or-more-things ys such that the ys M and they P.

(32) *The M that Qs Ps* is true iff: $y\text{s} \preccurlyeq^{*} c\text{ss} \rightarrow \text{Q}y\text{s}$
Everything that is among the *c*ss Qs (where the *c*ss are the chosen covering of the denotation of M).

Nicolas treats sentences like (26) in similar fashion; the full formal requirements are too involved to include here.

3.3 Problems With the Plural View

On first consideration, Nicolas' analysis of non-count expressions seems very promising, avoiding as it does all the problems characteristic of previous approaches and accounting for a wide variety of paradigmatic sentences in a systematic fashion. Nicolas' analysis is unlikely to fail on account of some straightforward puzzle-sentence like those introduced above. However, I contend that Nicolas' account fails to be topic-neutral and ontologically innocent. In this section, I argue for each of these conclusions in turn.

[7] " $\preccurlyeq^{\circ}$ " is another logical predicate, specially defined by Nicolas. How it differs from the regular *among* predicate is not material here.

To see how Nicolas' system fails to be topic-neutral, recall that it requires for the sentence *The wine in these glasses is the same wine that was in the bowl ten minutes ago* that there be "some small bits of [wine], each of which has retained its identity over time" (2008, p. 239). In general, in order to produce correct truth-conditions for sentences about substances rearranged over time, Nicolas' account requires that some bits of those substances persist across the rearrangement. And yet this is far from guaranteed. For instance, in

(33) The chili in this pot is the same chili that was in the two bowls before.

it is easily possible that, as the chili was poured from the bowls into the pot, it was so thoroughly mixed that there were no bits of *chili* (as opposed to individual beans and such) that survived the transfer. There are many analogous situations involving macroscopically-heterogeneous mixtures—think of *pie*, *succotash*, *garbage*, *barf*, etc.—and in principle it applies to any mixture at all. In general, the persistence of M-bits is a contingent worldly feature, one that could very easily fail to obtain. In requiring persistent M-bits in order to produce correct truth-conditions, therefore, Nicolas' account fails to be topic-neutral.

Now for ontological innocence. As noted in the introduction, plural logic—unlike predicate logic combined with set theory or mereology—is considered ontologically innocent in that it does not commit us to any additional entities beyond the individual objects required by predicate logic alone. For instance, a plural term may refer to three tomatoes without committing us to the existence of their set. However, Nicolas' use of plural logic to analyze non-count expressions does commit us to the existence of very many non-compound individuals. Recall that Nicolas defines the extension of a non-count expression as follows:

(34) $\text{DEN}(M, ds) \leftrightarrow \forall y\ (\text{M}y \leftrightarrow y \preccurlyeq ds)$
M denotes the ds iff: all things-that-are-M are among the ds, and nothing else is among the ds.

And Nicolas is committed to the existence of each of the ds—to, that is, the existence of each thing-that-is-M in the domain. So for instance, on Nicolas' view, talking about "the water in this bottle" commits one to the existence of the thing that is all-the-water-in-the-bottle taken as a whole, the thing that is the water in the bottom half of the bottle, the thing that is the water in the top half of the bottle, the thing that is a vertically zigzagging column of water molecules near the center of the bottle, and the thing that is some water molecules together forming the shape of a (very small) unicorn at the bottom of the bottle, along with many other such things—most of which would overlap with one another. To further complicate matters, suppose that over the course of a very rainy week a large quantity of water flowed through my basement, confounding my efforts to remove it with a Shop-Vac. If we follow Nicolas in requiring that every water-thing denoted by "the water in my basement" be self-connected, then many things would go in and out of existence whenever the water moved. If, on the other hand, we deny that the water-things must be self-connected, we would find ourselves committed to all manner of strangely scattered things: a small water-unicorn on one side of the basement plus a small water-dragon on the other side, a series of individual water-molecules all located three feet away from one another, etc.

To show why either of these clusters of commitments is problematic, we must clarify what exactly we mean by calling something "a thing." Some bit of reality is a thing, it seems truistically clear, when it is *countable as one*, and it stops being a thing when it can no longer be said to be *countable as one*. That is, each thing by definition has an essential metaphysical unity. Of course this unity might be of a weak sort that is not experientially or conceptually salient to human beings—proponents of mereological universalism embrace just such a thesis. But we should not be committed *as a matter of logic* to any particular world-structure—committed to, for instance, the existence of many different things as a consequence of talking

about a single thing. Predicate logic allows us to talk about the pen sitting on my desk without automatically attributing thinghood to any of the horizontal slices of pen-matter comprising my pen, for example; these might or might not be things, but the logic allows us to talk about the pen without bringing any of its parts into the conversation. Nicolas' account of non-count nouns, by contrast, explicitly requires the existence of many such sub-things by virtue of talking about a single thing, as we have seen in the preceding paragraph. If I want to talk about the water in my water-bottle or the water flowing through my basement, I must commit to the existence of very many individual overlapping waters. Or, to return to situations involving mixtures with vague subparts, if I want to talk about barf, I am as a matter of logic committed not only to the existence of an essentially unified thing called "a barf," but also to the existence of indeterminately many essentially unified overlapping sub-barfs. Such a state of affairs, needless to say, is deeply at odds with our stated goal of ontological parsimony; we are in need of something better. I offer such an alternative in the next section.

4 A New Approach to Non-Count Expressions

We have seen how every account that analyzes non-count expressions as referring to one or more things—one or more *countable-as-one*s—fails to be topic-neutral and ontologically innocent; these failures each stem from the fact that there is simply no collection of things that is both flexible enough to accommodate all the varied uses of non-count expressions across utterances and tidy enough to avoid inappropriate ontological commitments. The solution, I think, is to get rid of *things* altogether and instead analyze non-count expressions as representing a third distinct kind of talking and reasoning alongside singular and plural: *stuff-talk*, talk of the world in terms of no particular things.

However, it is far from clear how we might further characterize the meaningfulness and structure of stuff-talk, because, at least in the Western analytic sphere, our primary conceptual vocabulary and formalized variants thereof (logics, model theories, referential and semantic theories, etc.) all essentially depend on the *object* category, where objects are things, *countable-as-one*s. [8] If there is no thing that we are talking about, no thing that we are claiming to exist or to be the same as some other thing or to satisfy some predicate, and so on, it is hard not to draw the conclusion that we are talking about nothing—that is, that we are saying nothing meaningful.

Yet it still seems intuitively true that we can meaningfully talk and think about the chili in our kitchens and the water in our basements without talking and thinking about any particular chili-things or water-things, and we might hope to offer some theoretical characterization of such reasoning. In the remainder of this paper, I will sketch a new theory of stuff-talk, one that analyzes a non-count expression K as designating the contents of a time-space region that is non-empty in a K-way.

4.1 Stuff-Talk via Regions

On the account I present here, to assert that there is some K-stuff is simply to assert that some time-space region is non-empty in a K-way—and to say that some K-stuff exhibits a certain property is just to say that the contents of some time-space region, taken under a certain aspect, exhibit that property—while remaining neutral about the existence of any essentially unified K-things within that region. More specifically, I begin by reinterpreting first-order predicate logic as containing the following elements instead of their classical counterparts, to yield the language *NCFO* (for *non-count first-order*):

[8] Furthermore, it may well be that, as Quine (1969, pp. 1-25) argues, we cannot help but assimilate alien conceptual-ontological schemes to our own, supplying a more-or-less arbitrary ontology patterned after that of the familiar scheme to further specify the very rough translations between the familiar scheme and the unfamiliar scheme afforded by stimulus-meaning alone.

- A stock of constants $\boldsymbol{a}$, $\boldsymbol{b}$, $\boldsymbol{c}$, ... and variables $\boldsymbol{x}$, $\boldsymbol{y}$, $\boldsymbol{z}$, ..., which correspond to time-space regions with either a cumulative (non-scattered), intermediate (semi-scattered), or distributive (fully scattered) designating-relation (one of d_d, d_{i1}, d_{i2}, ..., d_c).
- N-place non-count predicates $\boldsymbol{P}$, $\boldsymbol{Q}$, $\boldsymbol{R}$, ..., which designate worldly properties/relations, and which are true iff they apply to the contents of the regions to which the relevant non-count terms are interpreted as corresponding.
- A non-count universal quantifier $\forall_{\boldsymbol{\mu}}$ (read "for all/any stuff") and non-count existential quantifier $\exists_{\boldsymbol{\mu}}$ (read "there is some"), ranging over time-space regions.
- The two-place logical predicates $=_{\boldsymbol{\mu}}$ (a non-count identity predicate read "non-empty with the same stuff") and $\preccurlyeq$ (read "is within").

The formation rules, axiom schemata, and inferences rules for *NCFO* are just those of classical predicate logic, plus a rule allowing the within-predicate to join two wffs to form another wff. The within-predicate is defined as follows:

(35) $y \preccurlyeq z \leftrightarrow \forall_{\mu} x\ (x \preccurlyeq y \rightarrow x \preccurlyeq z)$
Region-y is within region-z iff any region-x that is within region-y is also within region-z.

This allows us to define analogues of part-whole relations between a little stuff and some more stuff without committing to the existence of any part-things or whole-things:

(36) K-antisymmetry: $\mathrm{K}x \wedge \mathrm{K}y \wedge x \preccurlyeq y \wedge y \preccurlyeq x \rightarrow x = y$
If region-x and region-y are non-empty in a K-way, and region-x is within region-y, and region-y is within region-x, then region-y is identical with region-x.

(37) K-transitivity: $\mathrm{K}x \wedge \mathrm{K}y \wedge \mathrm{K}z \wedge x \preccurlyeq y \wedge y \preccurlyeq z \rightarrow x \preccurlyeq z$
If region-x, region-y, and region-z are non-empty in a K-way, and region-x is within region-y, and region-y is within region-z, then region-x is within region-z.

(38) K-strong supplementation: $\mathrm{K}x \wedge \mathrm{K}y \wedge \neg(y \preccurlyeq x) \rightarrow \exists z\ (\mathrm{K}z \wedge z \preccurlyeq y \wedge \neg \mathrm{O}zx)$
If region-x and region-y are non-empty in a K-way, and region-y is not within region-x, then there exists a region-z such that it is non-empty in a K-way, it is within region-y, and it does not overlap region-x.

A full semantics for non-count expressions using *NCFO* requires a specification of how non-count expressions connect up with the stuff they designate. Following what I take to be implicit linguistic convention, I propose that the specific time-space region corresponding to a given non-count expression be selected by a *maximality principle*:

each expression is paired with the largest and least-scattered time-space region to which the relevant predicates may apply, subject to non-linguistic contextual factors. So for instance, for the sentence "this wine cost two hundred dollars," the principle might select the non-scattered region demarcated by one bottle (if the wine is still in it), or to the region scattered across two bottles, or to the region scattered amongst several glasses (if it has all been poured), etc.

To see how this treatment avoids the problems outlined in preceding sections, consider the following sentences and their *NCFO* paraphrases:

(39) This wine cost two hundred dollars.
$\exists_\mu x\ (\mathrm{W}x \wedge \mathrm{C}x)$
There is a region-x such that it is non-empty winely and it is non-empty worth-two-hundred-dollarly.

(40) Some of the wine in this bowl is frozen.
$\exists_\mu x\ (\mathrm{W}x \wedge \mathrm{F}x \wedge \mathrm{B}x)$
There is a region-x such that it is non-empty frozen-winely and it is in the bowl.

(41) The wine in these glasses is the same wine that was in the bowl ten minutes ago.
$\exists_\mu x\ (\mathrm{W}x \wedge \mathrm{W}y \wedge \mathrm{B}_{t1}x \wedge \mathrm{G}_{t2}y \wedge x =_\mu y)$
There is a region-x such that it is non-empty winely and it is in the bowl at time-1; there is a region-y such that it is non-empty winely and it is in these glasses at time-2; and region-x and region-y are non-empty with the same stuff.

(42) All the furniture in this room is made of wood.
$\exists_\mu x\ (\mathrm{F}x \wedge \mathrm{R}x \wedge \mathrm{W}x \wedge \neg\exists_\mu y(\mathrm{F}y \wedge \mathrm{R}y \wedge \mathrm{W}y \wedge \neg(y \preccurlyeq x)))$
There exists a region-x such that it is non-empty furniturely, it is non-empty woodly, and it is in this room, and there does not exist any region-y such that it is non-empty furniturely, it is non-empty woodly, it is in this room, and it is not among region-x.

(43) All phosphorous is (exclusively) red or black.
$\forall_\mu x\ (\mathrm{P}x \rightarrow \mathrm{R}x \vee \mathrm{B}x \vee \exists_\mu y \exists_\mu z\ (\mathrm{P}y \wedge \mathrm{P}z \wedge \mathrm{R}y \wedge \mathrm{B}z \wedge \neg \mathrm{O}yz \wedge y \preccurlyeq x \wedge z \preccurlyeq x \wedge \neg\exists_\mu w\ (w \preccurlyeq x \wedge \neg(w \preccurlyeq y \wedge w \preccurlyeq z))))$
For each region-x that is non-empty phosphorously, either it is non-empty red-phosphorously; it is non-empty black-phosphorously; or there exists a region-y and a region-z such that region-y is non-empty red-phosphorously, region-z is non-empty black-phosphorously, region-y and region-z do not overlap, and region-y and region-z exactly compose region-x.

Using *NCFO*, we are able to represent these sentences as effectively as in Nicolas' system, avoiding as he does the problems associated with set-theoretic and mereological approaches, while also avoiding the objectionable ontological commitments Nicolas'

system requires.

The most obvious problem with the *NCFO* approach as laid out here is that it seems pragmatically inaccurate: it seems to analyze non-count expressions as designating time-space regions, but when we actually use non-count expressions, we seem to be designating the stuff in question directly. In everyday discourse, we talk and think about water, not about time-space regions that are non-empty waterly. How to avoid this problem? In the course of a comparison between Russell's and Frege's philosophies of language, Kaplan (1975, p. 722) introduces the notion of *artifacts of a model*:[9]

> When we construct a model of something, we must distinguish those features of the model which represent features of that which we model, from those features which are intrinsic to the model and play no representational role. The latter are *artifacts of the model*. For example, if we use string to make a model of a polygon, the shape of the model represents a feature of the polygon, and the size of the model may or may not represent a feature of the polygon, but the thickness and three-dimensionality of the string is certainly an artifact of the model.

It seems plausible that the time-space regions of *NCFO* may be construed as artifacts of its model rather than features of stuff-talk itself. That is, regions serve *mechanically* to pick out the boundaries of the stuff to be designated without requiring us to posit any things in the process, but they do not themselves figure *ontologically* in the theory. On this strategy, regions are merely the string that outlines the real content of interest, that which *NCFO* terms actually designate: the stuff as it is salient in the given utterance-context(s). Thus we might say that *NCFO* terms directly designate the stuff picked out by their corresponding regions without thereby committing ourselves to the existence of any things at all.

[9]Thanks to Kit Fine for bringing this article to my attention.

5 Conclusion

In this paper, I have summarized previous treatments of non-count expressions and enumerated their problems, both those already documented in the literature and new difficulties that arise when we move from truth-conditions for individual sentences to the general applicability of these analyses and the ontological commitments they require. This discussion lead to the conclusion that any analysis which reduces non-count expressions to singular talk about compound things or plural talk about simple things fails to be topic-neutral and ontologically innocent. I then outlined a semantics that treats non-count expressions as a distinct kind of reasoning that remains neutral about the existence of any things in particular. This system comes far closer to topic-neutrality and ontological innocence than any previous treatments while yielding intuitively correct truth conditions for well-known puzzle sentences; it lets us reason about the chili in our kitchens, the water in our basements, and even the barf on our floors without imposing extra logical or ontological baggage. As such, this account brings us much closer to knowing how to think about stuff.

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