

Abstract: Anyone who admits the existence of composite objects allows a certain kind of coincidence, coincidence of a thing with its parts. I argue here that a similar sort of coincidence, coincidence of a thing with the stuff that constitutes it, should be equally acceptable. Acknowledgement of this is enough to solve the traditional problem of the coincidence of a statue and the clay or bronze it is made of. I support this approach by indicating how predicating properties of stuff, quantifying with respect to stuff, and identifying and re-identifying stuff are all legitimate and perhaps even more fundamental than predication, quantification and re-identification with respect to individuals. I then indicate how singularist presuppositions have misled, and in an appendix I respond to a problem about coincident stuff.

When philosophers contemplate the relationship of an ordinary physical object to the stuff (clay or bronze, for example) that makes it up, they follow many different routes in trying to say something sensible.¹ For many, a core issue is the problem of coincidence.² If two objects coincide and share all of their qualitative physical properties, then what is the physical basis for predicating any different properties of them, and so what is the ground for distinguishing them at all? In particular, if the bronze in a statue is some thing, then that thing and the statue coincide and have the same purely qualitative physical properties. But then how could they be distinct individuals?

I will argue here that a proper ontology of matter (stuff) can help with the problem of coincidence. Zimmerman 1997 ("Coincident Objects: could a stuff ontology help?") is the most direct challenge to this idea. For example, Zimmerman endorses an argument he attributes to Burke: that such coincident individuals "could not differ in ... persistence

¹ See Burke 1992, 1994, 1997, Cartwright 1970, Chappell 1971 and 1973, Fine 2003, Jubien 1993, Koslicki 1999, Laycock 2006, Markosian 2004, Zimmerman 1995 and 1997, for example. (These examples selected from a vast literature because they take or discuss some different approaches to the ontology of stuff.)

² For example, Burke 1992, Zimmerman 1995, 1997. This is also called the 'the grounding problem,' Bennett 2004, for example.

conditions; there could be no ground for such a difference, since they are qualitatively identical and stand in the same relation to other things." (p. 20) But the presumption that we are talking about individuals is the very assumption that a stuff ontology should avoid. I will try to indicate how we can hold that the clay exists and has properties without being an individual.³

The suggestions offered here grow out of a more general consideration of mass terms and stuff, and they develop analogies with discussions of plural reference, predication and quantification. Here I will develop as much of those general ideas as I think are needed for answering puzzles about the relationship of the clay and the statue that is composed of it.⁴

Anyone who admits the existence of composite objects allows a certain kind of coincidence. Consider a table as a typical composite object; it coincides with a table-top and some legs. This does not immediately pose any problem of coincidence, since the

³ The idea that the clay is not an individual has been long argued by Henry Laycock. See Laycock 1972, 2006. However, I think that we can be even more rigorous in rejecting this idea, while developing a more systematic approach to the consideration of what the clay is. In particular, the connection with mass quantification, the general account of predication and quantification suggested here, the more rigorous avoidance of count terms in talking about stuff, and the suggestion of a more systematic development of mass term semantics all contribute. See McKay 2008 for some relevant discussion of Laycock 2006.

Markosian 2004 introduces a view of stuff that is like mine, but mainly in support of a different project. Burke 1997, 14-15, suggests this as a possibility for some cases. (Zimmerman 1997 responds to Burke's suggestion.)

⁴ I expect more to be available in other papers.

parts are many things. Most do not see this coincidence as posing the same kinds of issues as coincidence of a single individuals *a* with a single individual *b*.⁵

However, if a statue's bronze is a single entity, then its coincidence with the statue means that, at the time of coincidence, its qualitative physical properties and the statue's qualitative physical properties are the same, so they provide the same base for other properties, and so how could there be two distinct things? What could be the ground of any difference in persistence conditions, abilities or potentialities? (As Zimmerman 1997 notes, using the word 'entity' instead of 'thing' is no progress on the problem.) Though we might distinguish a thing from the things that constitute it, it seems difficult to distinguish a thing from some single thing that constitutes it.

At this point, a plural solution may suggest itself.⁶ If the clay is many things (its many atoms, for example), then coincidence of the clay and the statue is no more problematic than the coincidence of the table and its parts. But this solution is hard to justify, and it assumes that there are some composing individuals as a metaphysical and even as a semantic matter. That would be wrong.⁷

I think that we can develop a more satisfying resolution to the problem of coincidence,⁸ if we accept a few ideas that that we can explain and develop here.

⁵ Nihilists reject the idea of composite objects, and some philosophers argue that the table parts are identical to the table. Discussion of those views is outside our scope here. See McKay 2006, 36-42, for a discussion of many-one identity.

⁶ See Burke 1997.

⁷ Zimmerman 1995 argues very effectively in opposition to making this kind of assumption. Also, see Laycock 2006, pp. 43-44, for example.

⁸ In Bennett's evocative terminology, the choice has been conceived as a choice between being a one-thinger and a multi-thinger. I am suggesting that the paradigm problem of coincidence allows for a response by someone who adopts a one-thinger position. This allows for unobjectionable coincidence without requiring coincidence of individuals. I will remain neutral about whether we should allow coincidence of individuals; but by

1. We can talk about stuff (water, oatmeal, sand, etc.) without using any count nouns (not even 'entity'). Some water does not need to be some thing in order to exist or in order for us to talk about it.
2. Not all quantification is quantification over things. Quantification can be based on measurement rather than on counting and individuation. When I drink some water (two and a half cups of water; a lot of water) I drink some stuff, but there is no thing that I drink (or at least the existence of a thing that I drank is not a semantic consequence of the claim that I drank some water).
3. What we said about quantification applies to 'the'. The water I drank is some stuff but not a thing.
4. We can identify a general form for persistence conditions that every fundamental stuff term conforms to. Count terms must be associated with widely varied, term-specific, usually structure-constraining conditions of persistence. So we can ground the claim that I have the same bronze today as yesterday even though my bronze statue, the thing that was constituted by the bronze yesterday, has been melted and the bronze now constitutes a hood ornament. The bronze is not a thing, it is some stuff, and it has persistence conditions of a sort associated with every kind of stuff. The statue is a thing with the persistence conditions particular to statues (or perhaps more general to artifacts).

I will take up these four ideas in order, then discuss some details in Zimmerman 1997 more directly, and then (in an appendix) note a special problem that my account of stuff avoids.

1. Stuff talk without count nouns, and stuff without things

We can talk about stuff (water, oatmeal, sand, etc.) without using any count nouns (not even 'entity'). Some water does not need to be some thing in order to exist or in order for us to talk about it.

responding to the paradigm problem that leads to the multi-thinger position, perhaps I will undermine some of the motivation for it.

This ability can be the basis for a linguistic resolution, intended to enhance metaphysical perspicuity: let's talk about stuff without using any count nouns. Ordinarily not all of our speech conforms to that resolution, but we should be convinced that we could talk about stuff without using count nouns if we are to claim the kind of metaphysical independence of stuff that I wish to argue for. Occasional lapses should simply be cases of convenient but metaphysically misleading language.⁹ Let's consider some problems or seeming problems with this idea.

Problem 1: "I drank something very tasty at dinner." Isn't 'thing' a count noun, so isn't the naturalness of this a problem for the idea that we don't use count nouns to talk about stuff?

Solution: It is a *prima facie* problem for an empirical claim about how we speak, and a violation of our resolution. Certainly we use 'thing' to refer to what we drank, but there are two aspects to the response to this.

First, things might not be as they first appear. The word 'thing' might be part of a quantification over *kinds* of stuff; and kinds of stuff are count-noun-able even if concrete discussion of the stuff isn't. Many kinds (not *much kinds* or *much kind*) of wine are made in Tuscany, and much (not *many*) wine is consumed there. We can say *many wines*, but it is clear that that refers to kinds of wine, not the concrete stuff. I drank some stuff of a tasty kind.

We can also speak concretely about drinking very tasty stuff. Any use of 'something' in that connection can then be regarded as a convenient fiction that imports thing vocabulary, but that should not be taken as serious ontology. We could conform to our resolution even if we don't. (*I drank some very tasty stuff at dinner.*)

⁹ This will remind many of Strawson's idea of a "feature-placing" language. Fully exploring this connection must be work for another occasion. See Strawson 1953-54 and Strawson 1959 (especially pp. 208 ff.).

If we take the occurrence of 'thing' in 'everything' very seriously, then 'Everything that exists is a thing' is a truism. However, it is not true that whatever exists is a thing.¹⁰

Problem 2: When we give systematic truth-conditions for sentences, we must ask what assignments of things to variables or to argument places will satisfy a predicate. "That sand is black," is a case of predicating 'x is black', and "I walked in that sand" applies the relational predicate 'z walked in y'. The quantificational "Some sand is black" or "Much sand is black" will involve the predicates 'x is sand' and 'x is black'. If properties and relations are to be applied to stuff, then it seems that we must identify the individuals that are assigned to the argument places of such predicates, and quantification involving stuff ultimately relies on such predications as well.

Solution: Standard first-order logic's semantics builds on assignments to variables. Each such assignment assigns an individual to each variable. But it is well known that this has limitations; many have recently argued that the semantics of plurals must move beyond that, for example.¹¹ Standard first-order logic employs only individual, singular predication, but ordinary language also has non-distributive plural predication. ('They are surrounding the building,' 'They are meeting together,' etc.) We should not let the strictures of standard first-order logic mislead us about semantics or metaphysics.¹²

Similar things must be said about the use of mass terms. 'That sand' refers to some sand, but not to any individual. At this point it is fair to demand to see more of the systematic

¹⁰ Alternatively, we might distinguish between 'something' and 'some thing,' and between 'everything' and 'every thing,' to make the resolution somewhat less stringent about the use of 'everything' and 'something.'.

¹¹ See Boolos 1984 and 1985, Lewis 1991, McKay 2006, Oliver and Smiley 2001, Rayo 2002, and Yi 2005 and 2006, for example.

¹² In other words, those who follow Quine in believing that paraphrase into a canonical language makes ontological commitment clear will need a different canon to accommodate the suggestions being made here about plural and mass predication and quantification.

interpretation of mass terms as a part of a full reply to that. This develops in the course of discussing quantification, and we will turn to that soon. I think that we will be able to say enough to produce a pretty good idea of their role.

Much the same can be said about uses of pronouns. "The gold in Aunt Suzie's ring has been melted down, and it has been used to make another ring." What about the use of 'it' there? It would be represented by the use of a variable to which some stuff (rather than some thing) is assigned in the semantics. There are two rings and some constituting stuff. The stuff is not some third individual.¹³

Problem 3: We can say that the gold from Aunt Suzie's ring is identical to the gold in the new ring. Identity claims require identifying an individual. So the gold must be an individual.

Solution: Identity claims can also be plural or mass identity claims. When I say that the students in my class are the philosophy majors, I state a plural identity. When I say that the gold from Aunt Suzie's ring is identical to the gold in the new ring, I identify the stuff in the two rings. I do not need to suppose that the students in my class are some single thing in order to state the plural identity,¹⁴ and we should no more suppose that the mass identity statement requires that the gold is some single thing.

Problem 4: The responses to Problems 2 and 3 rely on an analogy between mass and plural language.¹⁵ But that analogy has important limitations. Plural and singular

¹³ I refer to Helen Cartwright's Aunt Suzie here (see Cartwright 1970, especially 27-28). Cartwright's influential view introduces reidentifiable "quantities" of matter as fundamental subjects of mass predication. The treatment of these quantities as individuals is precisely what I intend to avoid. Reidentifiable stuff does not need to be a reidentifiable thing or a reidentifiable set of things, as Cartwright assumes.

¹⁴ Though this assumption has sometimes been made (quite inexplicably). See Cartwright 1972, 27-28. Also Linnebo 2003, 79, discussed in McKay 2006, 29-30.

¹⁵ I thank Kris McDaniel for bringing out the need to respond to this here.

quantifiers have the same domain, but the domain for mass quantification must be different. And one might say that a plural identity statements are true in virtue of the truth of (perhaps lots of) singular identity statements. But nothing similar could be said about mass identity statements.

Response: That is all correct. At a fundamental level, I am taking mass terms to provide a basis for referring to some stuff without requiring that that stuff is some thing or things. This is supported by an appeal to some basic insights about our reference to stuff (see the solution to Problem 5), by the development of a systematic understanding of how mass terms work see (sections 2-4), by some consideration of the difference between measuring in general and counting (section 2), and by an articulation of fundamental principles concerning the identity and persistence of stuff (sections 2-4).

Problem 5: Doesn't 'That bronze' refer to a thing?

Solution: No. It refers to some stuff. We can have some particular stuff without its being some particular thing. The water in my basement, the coffee in my cup, the mashed potato on my plate, the bronze in the statue. Existence and particularity can attach to some stuff without that stuff's being some thing.

Problem 6: Doesn't 'The bronze the statue is made of' refer to a thing?

Solution: No. If it refers at all, it refers to some stuff. Of course, if we take a Russellian view of definite descriptions, or anything like it, we should be very suspicious of the idea that definite descriptions refer at all. Even if we do not do that, we need not take the description to refer to an individual rather than to some stuff.

We will talk about quantifiers first (section 2) and then move on to definite descriptions (section 3).

2. Quantification

Not all quantification is quantification over things. Quantification can be based on measurement rather than on counting and individuation. When I drink some water (two and a half cups of water; a lot of water) I drink some stuff, but there is no thing that I

drink (or at least the existence of a thing that I drink is not a semantic consequence of the claim that I drank some water).

Let's develop quantification involving mass terms. In particular, let's develop restricted quantification, creating a quantifier phrase from a quantifier expression and a mass term phrase (i.e., a mass term, with or without a relative clause or adjectival modifier). We will use lower-case Greek letters for mass variables, and we will discuss the status of those after we introduce the basic ideas. For example:

Much wine is red. [much α : $W\alpha$] $R\alpha$

Most wine Charlie drinks is red. [most α : $W\alpha \wedge Dc\alpha$] $R\alpha$

Because 'most' is a quantifier-word used with both mass and count terms, and because 'wine' has both a mass use and a count use (meaning *kind of wine*), the second English example may be ambiguous. Perhaps the English sentence could mean *most kinds of wine* ..., but we are interested in the mass meaning. Even that is somewhat unclear, though. Shall we measure by weight or volume in assessing whether most is red? This is not likely to matter for wine, though it might. If Charlie drinks his white wine very cold and his red wine very warm, then perhaps he drinks more white wine by weight and more red wine by volume. In order to evaluate a mass quantification, we need to identify a measure on the stuff. (This would not show up if we limited our consideration to 'some' and 'all'. And of course the need for restricted rather than unrestricted quantifiers also would not show up if we were interested only in 'some' and 'all'. Taking quantification seriously, we will consider quantifiers other than 'some' and 'all'.)

Questions may immediately arise concerning a number of elements of the formal representation I have suggested.

Q1: Can we have mass variables, variables to which no individual object is assigned?

A1: Yes. Assign some stuff instead.

Q2: Working from the quantificational representation of the sentence about Charlie, we might say: "Most wine such that Charlie drinks it is such that it is red." Doesn't the pronoun 'it' need to refer to some thing?

A2: No. It can refer to some stuff. In cases like this, it can be a device of cross-reference, marking an argument position that is bound by a quantifier (a quantifier with a mass variable rather than an individual variable, for the interpretation we are focusing on).

Q3: The mass term 'wine' is treated as a predicate in the formal representations above, but isn't it a mass **noun**?

A3: I am using the predicate 'is wine' instead of directly using the mass noun 'wine'. This is like the normal practice of using the predicate 'is a dog' instead of the count term 'dog' in the representation of 'Most (some, all) dogs bark'. A fuller treatment might introduce a new notation for both count and mass nouns, indicating how they have a special role in quantifier phrases and in some predications.

A quantifier phrase is constructed from a quantifier and a "common noun" (count or mass) phrase. Some might argue that a predicate like 'is a dog' should be constructed from a form of 'to be' and a quantifier phrase ('a dog'), and a predicate like 'are dogs' or 'is wine' should then be constructed from a form of 'to be' with a plural count term or a bare mass term. I expect to consider the issue of whether such an analysis is appropriate in other work, but there is no reason to burden this discussion with that additional development.

Every mass term is governed by principles analogous to mereological principles, where the fundamental relation is ' α is some (or all) of β ' ($\alpha \leq \beta$). For any mass term K , there is a relation \leq to which the following principles apply:¹⁶

AX1 [$\forall\alpha: K\alpha$] [$\forall\beta: K\beta$] ($\alpha \leq \beta$ iff [$\forall\gamma: K\gamma$](if $\gamma \leq \alpha$, then $\gamma \leq \beta$))

α is some of β iff any K -stuff γ is some of α only if it is some of β .

¹⁶ The English glosses here suppress the initial quantifiers; α and β are always assumed to be K -stuff. The formal versions are in any case definitive.

AX2 $[\forall\alpha: K\alpha] [\forall\beta: K\beta]$ (if $[\forall\gamma: K\gamma]$ (if $\gamma \leq \alpha$, then $[\exists\delta: K\delta]$ ($\delta \leq \gamma$ and $\delta \leq \beta$)), then $\alpha \leq \beta$)

We can define ' γ K-overlaps β ' (' γ K-O β ') as ' $[\exists\delta: K\delta]$ ($\delta \leq \gamma$ and $\delta \leq \beta$)'. Then we can rewrite **AX2**:

AX2O: $[\forall\alpha: K\alpha] [\forall\beta: K\beta]$ (if $[\forall\gamma: K\gamma]$ (if $\gamma \leq \alpha$, then γ K-O β), then $\alpha \leq \beta$).

if all K-stuff that is some of α K-overlaps β , then α is some of β .

AX2 is a version of mereology's *strong supplementation principle*. It is often presented in the equivalent contrapositive form:

AX2OC: $[\forall\alpha: K\alpha] [\forall\beta: K\beta]$ (if not - $\alpha \leq \beta$, then $[\exists\gamma: K\gamma]$ ($\gamma \leq \alpha$ and not- γ K-O β)).

if α is not some of β , then some K-stuff is some of α but does not K-overlap β .

These theorems follow from **AX1**:

M1 $[\forall\alpha: K\alpha] [\forall\beta: K\beta] [\forall\gamma: K\gamma]$ (if $\alpha \leq \beta$ and $\gamma \leq \alpha$, then $\gamma \leq \beta$)

M2 $[\forall\alpha: K\alpha] \alpha \leq \alpha$

We can say that α and β are the same K iff $K\alpha$, $K\beta$, $\alpha \leq \beta$, and $\beta \leq \alpha$. Equivalently (given **AX1**), α and β are the same K iff $K\alpha$, $K\beta$, and $[\forall\gamma: K\gamma]$ ($\gamma \leq \beta$ iff $\gamma \leq \alpha$). (This enables us to say that α and β are the same K even if a few electrons (or other non-K parts) are different, as long as all of the K is the same in α and β .)

It is a bit dangerous to read the relation-symbol ' \leq ' as 'is part of', even though its principles are like those of mereology. It is easy to slip from 'is part of' to 'is a part of' and that is a count term. To say that 'x is (a) part of y' might suggest that the argument positions must be occupied by terms for things. ' α is some of β ' should carry no such suggestion. (*This soup is some of the soup we cooked yesterday.*)

Quantification can then be given an account in terms of a measure on K and the \leq relation. A preliminary semantics might be built on this idea.

Some K is F iff the measure of K that is F > 0 .

Exactly three quarts of K is F iff the measure of K that is F is exactly three quarts.

Most K is F iff the measure of K that is F > the measure of K that is non-F.

All K is F iff the measure of K that is non-F = 0.

This is adequate for some simple quantification, when all predicates involved are cumulative.¹⁷ But things get more complicated when we consider other kinds of quantificational sentences.

Suppose that there are several pools of water in my basement. We can say that in each pool, some water is pooling together. This is a non-cumulative predication; the water in my basement is not all pooling together, even if all of it is in pools. (There can be some water α that is pooling together, and some water β that is pooling together, without its being true that α and β are pooling together.) This shows up clearly in the fact that the phrase "the water pooling together in my basement" is not interpretable, even though the predicate ' α is water pooling together in my basement' is not a problematic predicate. (More discussion of definite descriptions in the next section.) Because the predicate is non-cumulative, there is no measure of the water pooling together in my basement. (The total water in my basement might be 20 gallons, in 4, 5 and 11 gallon pools, for example. There is not 20 gallons pooling together.) As a result, the semantics suggested above does not directly apply.

An alternative semantics is applicable. We will first consider 'some'. Other quantifier terms will be defined relative to 'some' and a predicate of measure.

$[\exists\alpha: K\alpha] F\alpha$ ('Some K is F') is true iff ' Kx ' and ' Fx ' are true relative to an assignment of some stuff to ' x '.

To say that some K is F is to characterize some stuff as K and as F. Measure is not a part of that. We need only the idea that some (particular) stuff can have two features: for

¹⁷ A (mass) predicate F is K-cumulative iff the following condition holds: whenever α is some K that is F and β is some K that is F, then if γ is some K constituted by α and β together, then γ is F. (More strictly, if $K\gamma$ and $\neg[\exists\delta: K\delta \ \& \ \delta \leq \gamma] \neg(\delta \text{ K-overlaps } \alpha \text{ or } \delta \text{ K-overlaps } \beta)$, then γ is F.)

example, being water and being clear. Or being water and pooling together (or spreading out).

This may amount to no more than taking the fundamental notion of *some stuff* as primitive, since what we assign to 'x' is some stuff. Most important, though, is that there is no reason to regard this stuff as some thing, despite what some have said or assumed otherwise. We can identify and reidentify some water (just as we can identify and reidentify some people) without requiring that it is thereby some single thing.

For other non-proportional basic quantifiers (simple measurements, most clearly), the semantics is this:

[Q α : K α] F α ('Q K is F') is true iff some K is F and is Q in measure.

(I.e., the measure of some K that is F is Q.)

For a proportional quantifier (such as 'most', '3/4', etc.), we also need the idea of the totality of K.¹⁸ When the idea of totality makes no sense (as in the case of 'water that is pooling together', above), then the quantifier expression makes no sense. So we get semantic anomaly with proportional quantifiers in such cases. There is no such stuff as the water pooling together in my basement, because there are several separate pools. So there is no such stuff as most water pooling together in my basement. (This is analogous to issues for plural quantification.)¹⁹ A proportional quantifier can be defined as follows, in terms of the definite description and a proportional term ' α is Q of β ' (e.g., ' α is most of β '):

If [$\exists\alpha$: K α] \neg [$\exists\beta$: K β] $\neg\beta \leq \alpha$ is true,²⁰ then [Q α : K α] F α ('Q K is F') is true iff some stuff γ is all of the K, and some K is F and is Q of γ .²¹

¹⁸ Or the measure of the K that is non-F.

¹⁹ See McKay 2006, 61-63.

²⁰ Alternatively, we could write [$\exists\alpha$: K α] [$\forall\beta$: K β] $\beta \leq \alpha$, but I avoid explicit use of universal quantifiers here because of misunderstandings that can arise from their use. See the immediately following discussion of universals.

If $[\exists\alpha: K\alpha] \neg[\exists\beta: K\beta] \neg\beta \leq \alpha$ is not true, then $[Q\alpha: K\alpha] F\alpha$ is semantically anomalous (has no truth-value).

This will enable us to interpret a set of basic quantifiers, all of them existence-entailing quantifiers. Other quantifiers ('no', 'less than five quarts,') must be defined in terms of basic, existence-entailing quantifiers (with definitions like 'not some', 'not five quarts or more,' etc.)²²

When we speak concretely about stuff, our predominant mode of expression is quantificational, often with an implicit quantifier 'some'. ("Alice brought wine.") The use of mass terms in quantifier expressions best indicates their role. I think that an attention to the *reference* of mass terms has been misleading. We will need to interpret clauses like ' α is pooling together' ('That water is pooling together'), but the term 'water' needs to play a role in characterizing the stuff, not in referring to it. In a demonstrative phrase 'that water,' the demonstrative bears the referential role, just as it does in 'That dog is barking' (or 'Those dogs are barking'). We do not need a referential role for the term 'water' in either the demonstrative or quantificational context, just as we do not need a referential role for 'dog' in those contexts.²³ These terms characterize, are true of, what they apply to.

²¹ Bold-face **Q** will be the meta-linguistic expression used to interpret the quantifier Q. For example, if a quantifier μ is to mean 'most', then the metalanguage term used in the account will be 'most', or an account will be given, such as that the measure of γ that is F > the measure of γ that is not F.

²² There are issues about the interpretation of universal words with mass term (phrases). Consider the difference between "All of the zinc weighs forty kilograms" versus "Whatever is some zinc weighs forty kilograms." Compare to similar issues concerning plural quantifiers in McKay 2006 74-77.

²³ In the context of generic sentences like "Dogs bark" and "Water is widespread on Earth," a strong case can be made for a referential use, reference to a kind (abstractly or concretely conceived). But that is not the use here. Some others have argued that all uses of mass terms involve references of the sort that seems to be required for such generic

A demonstrative phrase may refer to a dog or some water, but the so-called "common noun" ('dog' or 'water') does not refer on its own.

Also, the emphasis on standard quantificational logic has usually misled people into taking singular quantification as the model for all quantification. People talk often of "quantifying over individuals". But we can assert the existence of some stuff without thereby asserting the existence of any individuals. And other mass quantification is at home as soon as we have an associated measure. Individuation introduces the possibility of counting as a basis for quantification (whether seen as an alternative to measuring or as a way of measuring). But quantification itself does not require the kind of individuation that many have assumed.²⁴

3 Definite descriptions

What we said about quantification applies to 'the'. The water I drink is some stuff but not a thing.

Let's say that

If $[\exists\alpha: K\alpha] [\forall\beta: K\beta] \beta \leq \alpha$ is true, then

[the $\alpha: K\alpha$] X is true if $[\exists\alpha: K\alpha \wedge [\forall\beta: K\beta] \beta \leq \alpha]$ X is true

[the $\alpha: K\alpha$] X is false if $[\exists\alpha: K\alpha \wedge [\forall\beta: K\beta] \beta \leq \alpha]$ X is false

If $[\exists\alpha: K\alpha] [\forall\beta: K\beta] \beta \leq \alpha$ is not true, then

sentences (Yi ms., Liebesman ms.), and a full discussion of this requires another occasion.

²⁴ This seems to be an apt place for a mention of Michael Jubien's 1993. There he takes an approach that is quite opposite to mine. I am saying that reidentifiable stuff need not and should not be identified as a thing; that is (roughly) what Jubien would identify as the only things. Despite that radical difference, there are affinities between our approaches. But these issues would require considerable space for a decent discussion. In particular, consideration of a 3D vs. 4D perspectives become relevant. (That is the source of the 'roughly' qualifier above.)

[the α : $K\alpha$] X is semantically anomalous (has no truth-value).

For our purposes, this neo-Sharvian (neo-neo-Russellian)²⁵ analysis serves one main purpose: it gives us a way to understand mass definite descriptions that does not see them as fundamentally involving reference to a thing or some things. Keeping in mind that a mass variable is associated with some stuff (not a thing), we should not be tempted to think that there is a reference to a thing here. Quantification is not in general associated with a reference to some thing, things or stuff. If ten students passed an exam, and I say that some students passed or that more than seven students passed, there is no reference to any particular students.

Russell distinguished denotation from reference, arguing that quantifiers and definite descriptions do not refer, they denote (at most). Even if we do not go as far as Russell on this point about definite descriptions, the analysis just given should provide no comfort to those who would argue that a mass definite description refers to an individual. It is important to keep this in mind in talking about stuff and in evaluating others' talk. The mere use of a definite description in denoting some bronze should not lead anyone to think that there must be some thing, rather than some stuff, that is denoted.

4 Persistence conditions

When we consider the issue of when some stuff K persists, and when some K at t is the same K as some K at t' , we can identify a general form for persistence conditions that every fundamental stuff term conforms to. No analogues are associated with count terms; count terms must be associated with widely varied, term-specific, usually structure-constraining conditions of persistence. So we can ground the claim that I have the same bronze today as yesterday even though my bronze statue, the thing that was constituted by the bronze yesterday, has been melted and the bronze now constitutes a hood ornament. The bronze is not a thing, it is some stuff, and it has persistence conditions of a

²⁵ Russell 1904, Sharvy 1980. This is Sharvian because it uses a totality condition rather than an identity condition. Sharvy's own analysis of mass definite descriptions is singularist, exactly what I wish to avoid.

sort associated with every kind of stuff. The statue was a thing with the persistence conditions particular to statues (or perhaps more general to artifacts), but it has lost the structure required for the persistence of a thing of that kind.

There are also special conditions of persistence that differ for mud, gold, oatmeal and furniture, etc. I won't try to articulate those.

To begin the consideration of persistence conditions, we can relate our previous principles for stuff to time. I will do that by adding a temporal parameter to the "some of" (\leq) relation. (Using temporal operators or, more radically, adopting a 4D perspective also have much to recommend them, but I won't explore those approaches here.) The most straightforward temporalizations of our axioms are, I think, unproblematic (given the addition of a time parameter to the "some of" relation).

AX1T $\forall t [\forall \alpha: K\alpha] [\forall \beta: K\beta] (\alpha \leq_t \beta \text{ iff } [\forall \gamma: K\gamma](\text{if } \gamma \leq_t \alpha, \text{ then } \gamma \leq_t \beta))$

AX2T $\forall t [\forall \alpha: K\alpha] [\forall \beta: K\beta] (\text{if } [\forall \gamma: K\gamma] (\text{if } \gamma \leq_t \alpha, \text{ then } [\exists \delta: K\delta] (\delta \leq_t \gamma \text{ and } \delta \leq_t \beta)), \text{ then } \alpha \leq_t \beta)$

But these versions indicate nothing about the relationship of some K-stuff at one time to some K-stuff at another time. I suggest that we add two more principles. The first is another version of **AX1**.

AX1P $\forall t [\forall \alpha: K\alpha] [\forall \beta: K\beta] (\alpha \leq_t \beta \text{ iff } \forall t' [\forall \gamma: K\gamma](\text{if } \gamma \leq_{t'} \alpha, \text{ then } \gamma \leq_{t'} \beta))$

Another principle, explicitly stating a temporal existence condition, will be necessary.

AXE $[\forall \alpha: K\alpha] [\forall \beta: K\beta] (\text{if } \alpha \leq_t \beta, \text{ then } \alpha \text{ and } \beta \text{ exist at } t)$

This might be seen as a consequence of more general principles governing temporalized existence. (Whatever stands in any relations at time t exists at t .) In any case, we can take it as an axiom governing \leq for our purposes.

A useful theorem follows from **AX1T** and **AXE**.

ThE $\forall t [\forall \beta: K\beta] (\beta \text{ exists at } t \text{ iff } \beta \leq_t \beta)$

We are now in a position to derive a constraint on the persistence of stuff: The relationship \leq that some K-stuff α bears to some K-stuff β undergoes temporal change

only if β ceases to exist while α continues to exist. As long as β continues to exist, $\alpha \leq \beta$, if it is ever the case that $\alpha \leq \beta$.

ThP $\forall t \forall t' [\forall \beta: K\beta] [\forall \gamma: K\gamma]$ (if β exists at t and t' , then ($\gamma \leq_t \beta$ iff $\gamma \leq_{t'} \beta$)).

One more axiom governing cross-temporal relations captures the idea that some K-stuff is just the K-stuff that it includes and nothing more. First we define the notion of being properly some of β in the obvious way:

$\alpha <_t \beta$ iff $\alpha \leq_t \beta$ and not $-\beta \leq_t \alpha$

Then we can state a principle for the existence of some stuff that relates it to the cross-temporal existence of the stuff it includes. This is an additional axiom.

AXC

$[\forall \beta: K\beta](\beta \text{ exists at } t \text{ iff } \exists t' (\beta \text{ exists at } t', \text{ and } [\forall \gamma: K\gamma](\text{if } \gamma <_{t'} \beta, \text{ then } \gamma \text{ exists at } t))$

(The left-to-right direction is a trivial consequence of other principles, but the right-to-left direction gives us the new condition we want on the existence of some stuff β .)

These stable features differentiate the *some of* relation (\leq) from the relation between an ordinary individual and its parts and indicate how the existence of some K-stuff requires no more than the existence of the K-stuff it includes. Most ordinary individuals have some replaceable (or at least losable) parts, making for much more challenging conditions of existence. I can replace parts on a statue, a bicycle, a car or a blender. Biological organisms undergo constant metabolic change in what stuff and things constitute them. In all of these count cases, an ideal count-kind predication is associated with a special principled basis for re-identification of the individual (in some range of circumstances), ordinarily based on historical continuity of material and/or structure, perhaps on fulfillment of a design. Those conditions of continuity are very different from the conditions based on the principles we have announced governing the \leq relation and the existence of some K-stuff. In the count-kind case, some special principles of continuity and difference must exist as a basis for individuation and countability. These features distinguish those things from the stuff they are made of.

When we apply count terms plurally, we can think of the principles of individuation as providing an "atomic" basis for a metric, so that we can define a *some of* relation for

individuals, the *among* relation, based on counting as one way to "measure." These are among (are some of) those. We can say how much gold we have by measuring it in some way (by volume or by weight); and since there are atoms of gold, we can also say how much there is by enumerating the gold atoms. We can say how much meat-on-the-hoof we have by saying how many feed-lots-worth (volume), how many tons (weight) or how many head (counting individuals). Once we have identified individuals, we have a new way to measure, by counting. But when the persistence conditions for the individuals do not include the persistence of the stuff that constitutes them at a particular time, then the count of individuals takes on a life of its own.

Let's suppose that Aldo has seven bronze statues, each weighing ten kilos. Aldo has seventy kilos of bronze. He could melt the statues. He would still have the bronze, but the statues would be destroyed. Alternatively, he could replace all of the statues' arms with tin. Then he would still have the statues, somewhat altered (by cheapening), and the bronze would now be a bit more scattered. The seventy kilos of bronze might still exist, even in this scattered state. The statues persist because the tin is the constitutive material of some statue-parts, and with these parts, we have material structurally arranged and historically related in a way that suffices for the continued existence of the statues, even though the bronze is no longer so arranged. But "statues-worth" is a totally unsuitable way to measure bronze under such conditions.

The *among* relation for plurals is governed by principles similar to those that govern the mass-relation \leq (*some of*). Using upper case plural variables for plurals,²⁶ we can state this analogue of **AX1**:

$$\forall X \forall Y (X \text{ are among } Y \text{ iff } \forall Z (\text{if } Z \text{ are among } X, \text{ then } Z \text{ are among } Y))$$

There is also a principle indicating the role of individuals:

$$\forall X \forall Y (X \text{ are among } Y \text{ iff } \forall z (\text{if } z \text{ is among } X, \text{ then } z \text{ is among } Y))$$

We also have an analogue of **AX2**:

²⁶ These "plural" quantifiers and variables are taken to apply to any one or more individuals.

$\forall X \forall Y$ (if [$\forall Z$: Z are among X] [$\exists W$: W are among Z] W are among Y, then X are among Y)

We also have a substantive principle that has no analogue for mass terms (as long as we do not assume atomicity of masses):

$\forall X \exists y$ y is among X

The existence of some individuals requires that at least one individual exists.²⁷ The analogues of the temporalized axioms are also true.

Following up on this analogy, we might also see plural quantification as a special case of the general quantification that we have for mass terms. The conditions for some things X being among some things Y are like those for some stuff α 's being some of stuff β . But X are individuals, providing an automatic "atomic" structure to X. When we have some people, each person is an "atom" of them. Alternatively, for atomically structured stuff, plural quantification and counting might serve to replace much of our ordinary mass quantification. But we don't want to assume that all mass terms must have such atomic structure,²⁸ so measure is the more general requirement.

The bronze in a statue is some stuff that can exist before the statue does. It is not a thing, since it does not have thing-like persistence conditions. It can outlast the statue (at least it can in a world more stable than this one), if the statue's structural conditions of existence cease to be fulfilled. It can become scattered as the statue continues to exist unscattered, if the statue's structural conditions of individuality, existence and continuity continue to be fulfilled (with importation of new stuff to take the place of the old, if necessary).

Note that we can say much the same thing about some statues. *The bronze in the statues is some stuff that could have existed before the statues did. It is not a thing, since it does not have thing-like persistence conditions. It can outlast the statues (at least it can in a*

²⁷ See McKay 2006, Chapter 6 for development of this for plurals. The presence of this axiom indicates again the fundamental fact that singular and plural quantification have the same domain. (Thanks again to Kris McDaniel for emphasizing this point.)

²⁸ Zimmerman 1995 and Laycock 2006, for example. See note 6.

world more stable than this one), if some of the statues' structural conditions of existence cease to be fulfilled. It can become scattered as the statues continue to exist, if all of the statues' structural conditions of individuality, existence and continuity continue to be fulfilled (with importation of new stuff to take the place of the old, if necessary). The singular (the case of one statue) appears to be just a special case of the plural.

Conclusion

In so far as the problem of coincidence is a problem about the relationship between a thing and the stuff of which it is constituted, we have solved it.²⁹ Stuff and things have different continuity conditions. The continuity conditions for things are related to kind-specific principles of structure that ground the individuation of things of that kind. In contrast, there are many substantive conditions of continuity for stuff that are instances of some general forms that apply to every kind of stuff.

The fundamental singularism of standard first-order logic has led philosophers to try to identify single things that can serve as values of variables. This bias has made it impossible to deal with plural and mass predication and quantification in a sound way. The suggestion here is that we can solve some real philosophical problems if we recognize mass and plural predication and quantification as legitimate on their own, without a singularist reduction. And in fact, we might even be able to achieve some generality in our account of predication and quantification if we take mass predication as basic and then treat plural and singular quantification as special cases.³⁰

²⁹ We have not touched the problem of whether distinct things can coincide. We have addressed only the case of a thing's coincidence with the stuff that constitutes it.

³⁰ This idea is suggested by what we have done, but more would be required to make a case for that kind of fundamentality for mass predication and quantification.

5 The thinginess presupposition

Is useful to see how inappropriate presuppositions about mass terms affect the setting of the problem of coincidence from the outset. Zimmerman's article (1997) is our most relevant example, and its first page includes these remarks.

What is the relationship between the statue and the copper of which it is made, between the ice sculpture and the water of which it is constituted, between my body and the cellular tissue now making it up? And what sorts of things are these constituting entities, the referents of mass terms preceded by definite or indefinite article ...?

There are two relatively familiar sets of answers to these questions: (1) The quantities or masses of stuff in question are themselves physical objects, wholes, that spatially coincide with the objects they constitute; and (2) the quantities or masses of stuff in question are sets or pluralities, the members of which are all parts of the constituted objects.

The first remark assumes that we must find some constituting entities that are the copper, the water, or the cellular matter. That is the first presupposition that we challenge. Water exists, but neither 'entity' nor any other count noun needs to apply to water in order for it to be some stuff. The first remark also assumes that we must find referents for mass terms. But their role is in characterizing some stuff, not in referring to it. So we are sent out on the wrong hunt from the beginning.

The second remark assumes that that we must find a plural or a singular answer to the question of what the stuff is. I have explored an answer that is neither, suggesting even that plural and singular might be special cases of the more general stuff predication and quantification.

Zimmerman sets his problem as the consideration of whether a stuff ontology might help with the problem of coincidence (p. 20), and he describes it as "an ontological category located somewhere between mere plurality and individual physical object or whole." He reiterates this "in-between" characterization of stuff (p. 22), but the characterization I have developed here in no way places stuff between wholes and pluralities. If anything, talk of stuff is more basic than either of those. Zimmerman presupposes a picture here that seems not to be applicable. We are on the wrong hunt and we have the wrong map. But have we answered the ultimate challenge of coincidence? Zimmerman (23):

How does withholding the label 'thing' or 'object' from the bronze help mitigate problems posed by its coincidence with the statue? ... How can distinct entities exhibit all the same qualitative properties and relation to other things, and yet the one be a mere stuff while the other is a real object? How can they differ in persistence conditions and kind when they are qualitatively and relationally identical?

Some stuff can coincide with a thing (as the bronze coincides with the statue) or with several things (as some bronze might constitute Aldo's seven statues). Although some bronze and a statue it composes share some properties (have the same weight and location), they differ in many. The bronze is such that any bronze that is some of it is essentially some of it (it has the persistence conditions for stuff, not for a thing of some kind); the statue does not have that property, and it does not even have the analogous property that every part of it is essentially part of it (it has the persistence conditions for a thing of the kind *statue*.)

Zimmerman himself allows that the problem of coincidence does not arise when some thing coincides with some things, as the statue coincides with the atoms that compose it, or as a table coincides with a table-top and some legs, because the fact that the atoms and the statue, or the table and the table-parts, coincide "does not imply that there are two precisely coincident things." (p. 19) It is only by making presuppositions that keep forcing the identification of the bronze as a thing that he is able to argue that a stuff ontology requires coinciding things. By avoiding those presuppositions, we can see our way clear to say how some stuff can coincide with a thing. The stuff exists without being any thing, though it may be the stuff some things are made of.

Appendix The Kleinschmidt Problem

When some stuff K has identifiable "atoms", questions arise about the relationship of the K to the atoms and to the stuff, if any, that composes the atoms. Shieva Kleinschmidt has shown how this raises an interesting issue about the coincidence problem and a stuff-solution of the kind I have offered. Here are some examples that illustrate the problem.³¹

³¹ "Some Things About Stuff." The water and oatmeal examples that follow are revisions of her examples, preserving what is essential for us to consider.

Furniture: Consider some furniture α that is made entirely of some wood β . The pieces of furniture are the "atoms" of the furniture. (Although 'furniture' is not a paradigmatic stuff term, it has the grammar of a mass term, and considering it raises this problem in a clear way.) β can outlast α (if the furniture is smashed), and α can outlast β (if some wood is removed and destroyed while proper replacements are placed on the pieces of furniture). Thus it seems that we must allow for distinct but coincident stuff (α and β), on the same grounds that we must allow that some stuff can coincide with some distinct thing or things.

Water: Suppose that I have a one-gallon puddle of water. The water is composed of H₂O molecules, and they are composed of hydrogen and oxygen particles ("atoms" in the non-philosophical sense). Let's suppose that those particles are composed of particle-stuff (to make a potentially very long story short). The water and the particle-stuff are of the same ontological category (stuff), they are co-located, but they have different persistence conditions. If some of the H₂O molecules break apart, we no longer have the same water, but we might have the same particle-stuff. So we seem to have the same kind of co-location problem that we had for the statue and the piece of bronze from which it is fashioned.

Oatmeal: Suppose that I have a cup of oatmeal. I have a cup of suitably processed oats, and they are made from oat-stuff. The oatmeal and the oat-stuff are co-located. But they have different persistence conditions, since I could smash the oats into tiny fragments that would be too small to constitute oatmeal but that would still preserve all of the oat-stuff. So this stuff α (oatmeal) and stuff β (oat-stuff) are co-located but not identical.

The approach I have taken has already built in distinctness of identity conditions for stuff related in the indicated way. Our axioms are all formulated as principles for K-stuff, for each kind of K-stuff, but not as principles for stuff in general. The general schemas apply to each kind of stuff, but the principles will in fact differ, since each actual axiom involves a particular stuff-kind term. Thus these examples do not create any formal conflict. The water and the particle-stuff might be co-located. Even so, our principles dictate only how the gallon of water is related to any water that is some of it and how the gallon of particle-stuff is related to any particle-stuff that is some of it. The basic axioms

are neutral about the issue of whether any stuff is some of the water and also some of the particle-stuff.

If the particle-stuff can outlast the water, then they must be different stuff. But there is no problem in distinguishing them; they have different persistence conditions (though the persistence conditions are of the same general form). There are also other differences between water and particle-stuff. The water is composed of water molecules, but the particle-stuff isn't. The particle-stuff composes the molecular particles, but the water doesn't.

If one holds that constitution is not identity, then the gallon of water, and the gallon of hydrogen and oxygen particles, and the gallon of particle-stuff, are all distinct, though co-located. Because of the constitution relations that exist, we do not have two, three or more gallons of whatever in one place. The co-location of the water and the particle-stuff is not more intrinsically puzzling than the co-location of the water and the particles, something that no one would regard as problematic. One gallon of water is constituted by one gallon of H and O particles suitably structured.

If one holds that constitution of x by something y from the same general category must be identity, then one will have some issues to deal with in the case of co-located stuff. (This does not seem a promising route at all to me.)

Summary: The Kleinschmidt problem is not an issue of immediate concern. Since the axiom-schemas for mass-kinds apply separately to each kind of stuff, we run into no formal conflict. Those who hold that constitution is identity may run into some problems, but the exact nature of those problems would need more exploration. I leave it to them.

This solution may seem unsettling, though. If we can solve the problem of coincidence simply by denying that coincidence is identity, then why did we need to go through all of the more complicated discussion of this paper? Maybe we didn't. But for those who see the problem of coincident objects as trouble, we have done the work we need to differentiate this problem (the problem of coincident stuff) from that.

Consider some furniture γ made of wood β . When we have some furniture, it is "atomically" structured. Each piece of furniture (chair, table, etc.) is an atom, and we can

imagine a case where each piece is made entirely of wood. Each piece is some furniture. But not every part of each piece is furniture. The lower half of the right leg of a chair is not furniture, though it is wood. Although any wood α that is some of the wood β is some of β at all times at which β exists, some wood (like the bottom half of one leg of a chair) is some of β and not some of the furniture γ . So α and β must be distinct. Principles governing the \leq relation and the persistence of stuff will apply to the furniture and to the wood, and the principles will have the same form, but they are different principles.

The main goal of this paper has been to provide an understanding of stuff, and to encourage a willingness to talk about stuff without assuming that we are thereby talking about things, and to apply this to issues of mass-thing coincidence. The principles we have are also sufficient to ground an understanding of stuff that permits coincident stuff. No similar set of uniform principles ground an understanding of things that permits thing-thing coincidence. I have in no way argued that there is or is not a principled basis for allowing thing-thing coincidence, but only that we can solve the most important form of the coincidence problem without admitting coincident things.³²

³² I thanks José Benardete, Karen Bennett, André Gallois, Mark Heller, David Liebesman, Kris McDaniel, Ted Sider, Mark Steen and Byeong-Uk Yi for their helpful comments on drafts of this paper. I also thank the participants in my Fall 2008 seminar: Mihnea Capraru, Paul DuBois, James Lee, David Liebesman, Jay Rourke, and Aaron Wolf for their useful discussions of this and related topics.

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