Vague Objects and the Problem of the Many

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Abstract

The problem of the many poses the task of explaining mereological indeterminacy of ordinary objects in a way that sustains our familiar practice of counting these objects. The aim of this essay is to develop a solution to the problem of the many that is based on an account of mereological indeterminacy as having its source in how ordinary objects are, independently of how we represent them. At the center of the account stands a quasi-hylomorphic ontology of ordinary objects as material objects with multiple individual forms.

Keywords

Vagueness, indeterminacy, material objects, problem of the many

Objects with indeterminate mereological boundaries raise the problem of the many. Mountain M is the sole mountain on an open plain. M is composed of rocks. For many rocks on M's surface it is unclear whether they are parts of M. M is mereologically indeterminate. So there are many ways of drawing the mountain's boundary. Assuming that for each set of rocks there is an aggregate of rocks, each boundary we can draw has a corresponding aggregate of rocks. Each of these aggregates is a candidate to be the mountain on the plain, M. Can we single out one of these candidates as M? It seems not. For each of the aggregates seems to be an equally good candidate to be the mountain. None of them is special. But if each of them is a mountain, then we have many mountains on the plain. And if none of them is a mountain, then we have no mountain on the plain. Either way, it is not the case that there is one mountain on the plain, as we expected. This problem arises for all macroscopic material objects with fuzzy boundaries.[1]

The task posed by this problem is to explain mereological indeterminacy of ordinary objects in a way that sustains our familiar practice of counting these objects. We can structure this task by distinguishing between two types of explanation of mereological indeterminacy. Consider a particular instance of such indeterminacy: It is indeterminate whether mountain M has rock r as a part (at some time). This indeterminacy claim has a *de dicto* reading, 'It is indeterminate whether: M has r as a part', and a *de re* reading, 'M and the property of having r as a part are such that it is indeterminate whether: this object instantiates this property', where the colon is used to indicate the scope of the operator 'It is indeterminate whether'. While on the *de*

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[1] See Unger 1980 and Geach 1962.

dicto reading it is indeterminate whether a certain description of the world is true, on the *de re* reading it is indeterminate *of* a particular object and a particular property, whether the latter applies to the former. I shall say that if the *de re* reading of any claim of mereological indeterminacy is true, then there are vague objects. Now, on the first type of explanation of mereological indeterminacy, all such indeterminacy is merely *de dicto* and has its source in how we represent the world. On this approach, there are no vague objects. On the second type of explanation, at least some mereological indeterminacy is *de re* and has its source in how the world is, independently of how we represent it. On this approach, there are vague objects.

My aim in this essay is to develop a solution to the problem of the many that is based on a *de re* account of mereological indeterminacy. In order to provide some background, I shall begin with a brief critical discussion of what is probably the most popular solution, namely, the standard supervaluationist solution, which is based on a *de dicto* account. While I won't have the space to show my solution to be superior to all known approaches to the problem, I hope to make a case for this solution to be taken seriously.[2]

1   Indeterminacy *De Dicto* and the Problem of the Many

Supervaluationism is the dominant brand of linguistic theory of indeterminacy.[3] To the supervaluationist, indeterminacy arises as a result of semantic imprecision, where an expression is semantically imprecise when its meaning can be extended, can be made precise in different ways. Some but not all precisifications of the expression are consistent with speakers' use of the expression; they are the admissible precisifications. Supervaluational truth conditions of statements containing imprecise expressions may be specified in terms of the notion of truth on an admissible precisification I of all imprecise expressions in the object-language, by means of which notion super-truth and super-falsity are defined. A sentence s is super-true iff s is true on all Is, s is super-false iff s is false on all Is, and s is neither super-true nor super-false iff s is true on some but not all Is. Truth in the imprecise object-language

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[2] I said that the problem of the many poses the task of explaining mereological indeterminacy of ordinary objects in a way that sustains our familiar practice of counting these objects. The solutions to be discussed here embrace this task. Various other known solutions are less ambitious. Unger (1980), for example, draws the conclusion that there are many mountains or none, thereby giving up on our intuitive cardinality claim that there is a single mountain on the plain. Markosian (1998), by contrast, tries to capture this uniqueness claim by arguing that among many largely overlapping pluralities of rocks on the plain only one such plurality has a fusion. This approach, however, leaves the mountain's fuzzy boundary in the dark. An account of mereological indeterminacy is not part of the package. To mention a third approach, Lewis (1993) accepts that while each of the aggregates is a mountain, the common-sense claim that there is only one mountain on the plain is preserved, as ordinary speakers don't count by strict identity, but rather by the weaker relation of massive overlap. This is an attempt to get the uniqueness claim to come out true. But the approach by itself offers no handle on mereological indeterminacy. See Sattig 2010 for criticism along these lines.

[3] For classical presentations of supervaluationism, see Fine 1975 and van Fraassen 1966.

is super-truth; and falsity in the object-language is super-falsity. Given these metalinguistic notions of super-truth and super-falsity, how are claims of determinacy and indeterminacy in the object-language to be understood? According to standard supervaluationism, ⌜Determinately, s⌝ is true iff s is super-true. Indeterminacy of s may then be expressed by saying that neither determinately s nor determinately not s. This is the rough framework.

How can it be true that mountain M has an indeterminate mereological boundary? According to standard supervaluationism, such indeterminacy arises from imprecision in how we refer to ordinary objects, an imprecision that depends on the nature of ordinary sortal concepts. In the case at hand, there is a cluster of massively overlapping aggregates of rocks with different precise decompositions (at a given time), such that each of these aggregates is a candidate referent for the name 'M'. Each of these aggregates is a candidate to be designated by 'M' because the name purports to designate a unique object falling under the sortal concept of a mountain, and because each of the massively overlapping candidates has what it takes to be a mountain. The multitude of candidate referents thus depends on the fact that the sortal fails to select a single aggregate out of a cluster of massively overlapping ones. It is then indeterminate whether: M has r as a part, since it is true of some admissible precisification of 'M' that it has r as a part, but not true of all admissible precisifications of 'M'. The standard supervaluationist thus accepts the *de dicto* reading of our indeterminacy claim about M. But she rejects the *de re* reading because it is not the case of M that it is indeterminate whether: it has r as a part, as each candidate referent has a clear-cut decomposition. There are no vague mountains in this world.[4]

The standard supervaluationist account of mereological indeterminacy faces the problem of the many in the following way. Out there on the plain, there is exactly one mountain, M—or so we think. Yet, according to the standard supervaluationist, we are not managing to refer to a unique object. There is, rather, a multitude of candidates to be the mountain, M. If among many candidates a single one is a mountain, then there must be a fact of the matter singling out one candidate. Since each candidate has everything it takes to be a mountain, each of them is an equally good candidate to be the mountain, and hence there is no fact of the matter singling out one candidate. It follows that there are many mountains or none where we thought there was just one.

The standard supervaluationist offers the following reply. The sortal concept of a mountain, or the sortal term, is imprecise. Each of the many mountain-candidates on the plain is neither clearly a mountain nor clearly not a mountain—that is, it is unclear whether the concept applies to any of them.[5] And yet it is true that there is exactly one mountain on the plain. The trick is to say that on each admissible precisification of the sortal concept of a mountain, the latter applies to exactly one of the massively overlapping candidates on the plain. It is then true across all

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[4] A standard and plausible assumption in the background is that the predicate 'is a part of' is a precise predicate. The mereological indeterminacy is meant to have its exclusive source in the imprecision of 'M', which derives from the imprecision of the sortal *mountain* associated with 'M'. This treatment of ordinary mereological indeterminacy is most prominently endorsed by Lewis (1993).

[5] I shall assume that 'the set of mountain-candidates' is precise, and thereby ignore issues of higher-order vagueness.

precisifications of the sortal that there is one mountain over there, although it is not true of any of these candidates that it is the mountain. The existential statement is true although none of its instances is true.[6]

This response is hard to accept. I shall focus on an objection that I find particularly pressing.[7] The crux of the supervaluationist approach to the problem of the many is that each precisification of the sortal *mountain* singles out exactly one of the many candidates. But how does that work? Does each precisification specify a complex property that tells us precisely what makes an object a mountain, and that only one of the candidates has? In other words, is each precisification principled? This is hard to believe, given that the overlapping candidates may differ only minutely, by a rock or two. It seems that any such property would either apply to several of the candidates, making it false that there is one mountain on the plain, or it would fail to apply to any, or sufficiently many, aggregates of rocks elsewhere, making it false that there are a few thousand mountains in Switzerland.

Then maybe the various precisifications single out one candidate "blindly", in the sense that, on each precisifiation, the sortal applies to one arbitrary candidate. This, however, is implausible. It is a natural view about the application conditions of *mountain* that if some objects are mountains, they must be so in virtue of other properties. This explanatory requirement is independent of considerations of vagueness and indeterminacy. What stands behind it is the metaphysical thought that mountainhood is not a fundamental property—that mountainhood is not among the properties that ground all other properties in the universe. If supervaluationism is to satisfy this explanatory requirement, then it must be the case that on each precisification of *mountain*, an object is a mountain in virtue of having certain more fundamental properties. Yet if precisifications of *mountain* are abritrary, then mountainhood applies primitively to different objects on different precisifications. (Perhaps we should rather say that distinct properties of mountainhood corresponding to distinct precisifications of the sortal apply primitively.) Hence, facts about mountains are not grounded in mountainhood-free facts.

2   Indeterminacy *De Re* and the Problem of the Many

An alternative to the construal of ordinary mereological indeterminacy as *de dicto* is the view that such indeterminacy is *de re*. What is the nature of mereological indeterminacy *de re*? And how could the problem of the many be solved on the basis of a *de re* account of mereological indeterminacy? In the remainder of this essay, I shall try to answer these questions.

As regards the nature of mereological indeterminacy *de re*, it is common to construe it, along with metaphysical indeterminacy in general, as fundamental, either in the sense that facts about such indeterminacy are not grounded in any more basic, indeterminacy-free facts, or in the sense that the operator 'it is indeterminate whether'

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[6] This solution appears in Lewis 1993, McGee and McLaughlin 2000, Heller 1990 and Lowe 1995.

[7] A forceful rendition of the ensuing objection is presented in McKinnon 2002. See Hudson 2001, Ch.1 and Weatherson 2003, 2009 for overviews of further objections.

is perfectly natural, that it "carves nature at the joints". Friends of this view often emphasize that while metaphysical indeterminacy cannot be analysed reductively, the notion can still be elucidated. That it is indeterminate of mountain M whether: it has rock r as a part could be made intelligible by saying that reality itself has different precisifications, all of which are perfectly precise, including one in which M has r as a part and one in which M lacks r as a part.[8]

As regards the problem of the many, recall that if the indeterminate boundaries of mountains are understood in terms of mereological differences between a plurality of overlapping aggregates of rocks, then it is is hard to uphold our intuitive claim that there is exactly one mountain on the plain. If, however, mountains get to be vague objects, then we are in a position to recognize but a single mountain on the plain, and to attribute a mereologically indeterminate boundary to it. So far, so good. But what grounds the fact that there is exactly one vague mountain on the plain, as we would expect, as opposed to many? On the original assumption that composition is always determinate, there was the problem of explaining why among many largely overlapping pluralities of rocks only one plurality of rocks composes a precise mountain, such that each of these rocks is a determinate part of the mountain. On the new assumption that composition can be indeterminate, there is the problem of explaining why among many largely overlapping pluralities of rocks only one plurality of rocks composes a vague mountain, such that each of these rocks is a determinate part or an indeterminate part of the mountain.

I shall not address this question within the framework of fundamental mereological indeterminacy. Whatever the prospects of solving the problem of the many by recourse to such a picture of indeterminacy, I am opposed to that picture in the first place. My main reason is the philosophical intuition that reality is not fundamentally indeterminate, that indeterminacy doesn't run that deep. Furthermore, if theoretical problems concerning mereological indeterminacy can be handled without recognizing this indeterminacy as metaphysically ultimate, then this picture violates the methodological principle that fundamental facts must not be multiplied without necessity.[9] The problem of the many is one problem that can be solved without going fundamental. In what follows, I shall sketch an account of mereological indeterminacy *de re* as nonfundamental, for the purpose of offering a solution to the problem of the many that is metaphysically painless and superior to the popular supervaluationist solution. The new picture is based on a quasi-hylomorphic ontology of ordinary objects, such as mountains, as material objects with multiple "superimposed" individual forms. This ontology is my starting point.[10]

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[8] For constructive discussion of metaphysical indeterminacy, see, *inter alia*, Akiba 2000, 2004, Barnes 2010, Barnes and Williams 2009, 2011, Morreau 2002, Parsons 2000, Rosen and Smith 2004, Smith 2005, Williams 2008, and Williamson 2003.

[9] For a statement of this principle, see Schaffer 2009, 361.

[10] The picture to be sketched below is developed in more detail and with further applications in Sattig forthcoming b. For an application of the framework to an argument against vague objects by Brian Weatherson (2003, §4), see Sattig forthcoming a.

2.1 Ordinary objects with multiple individual forms

While the sortal *mountain* may plausibly be viewed as being semantically imprecise, applying to different sets of objects under different precisifications, this semantic imprecision will be set aside in the following treatment of ordinary mereological indeterminacy as it occurs in the case of mountain M, since such indeterminacy does not have its source in the semantic imprecision of *mountain* (see §1). It will thus be assumed that the sortal is precise. With this assumption in place, let us turn to the notion of a *K-state*.

For any ordinary kind K (corresponding to the sortal concept of a K), there are specific properties (and relations) of material objects that partially realize, or ground, the kind. Suppose, for example, that material object a has properties that jointly realize the kind *mountain*. Among its mountain-realizers are not only its specific shape and its specific altitude, but also the property of having a mereological and spatial boundary that is sufficiently contrasted from its environment. I shall call a K-realizing boundary of a material object a *K-boundary*. Comparing a mountain-shaped aggregate of rocks covered in snow with a mountain-shaped aggregate completely enclosed in a bigger aggregate of rocks, the former has a mountain-boundary, while the latter does not.[11]

Moreover, for any ordinary kind K, a *K-state* of a material object is a conjunctive fact about the object, which is associated with the kind in virtue of its constituent K-realizing properties (and that obtains at a particular time). A K-state of object a is the maximal conjunction of the facts that a has φ_1, that a has φ_2, ..., that a has φ_n, such that each φ_i is an intrinsic property of a or a property of a that realizes K. A K-state is an instantaneous, intrinsic and K-realizing profile of a material object. Some ordinary kinds are presumably completely realized by intrinsic properties of material objects, while others are partially realized by extrinsic as well as intrinsic properties. A mountain-state—in short, an *m-state*—of a material object a is a conjunctive fact that contains all intrinsic and mountainhood-realizing properties of a (at a given time), including a's mountain-boundary.

K-states are instantiated by composite material objects. I shall make three metaphysical assumptions about these objects. First, composite material objects exist. Second, there is no fundamental metaphysical indeterminacy, and hence material objects, composite or not, are clear-cut. So it is not fundamentally indeterminate of any material object and any property whether the former has the latter. Third, composite material objects are mereological sums of material objects that overlap with a massive number of other composite material objects at any time, assuming mereological universalism, the principle that any plurality of objects has a sum.

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[11] If the sortal *mountain* is semantically imprecise, then different properties of material objects realize the sortal on different precisifications. In particular, different precisifications of the sortal specify different minimal degrees of boundary contrast, and hence specify different sets of eligible mountain-boundaries. This semantic indeterminacy will not play a role here. Since I claim that mereological indeterminacy as it occurs in the case of M does not have its source in the semantic imprecision of *mountain*, I shall assume, for simplicity, that it is always a precise matter which properties realize which sortals, or kinds. Indeterminacy emanating from semantic imprecision of sortals requires a separate treatment. For further details, see Sattig forthcoming b.

On the assumption of mereological universalism, its seems plausible that given a mountain-shaped material object *a* with a certain mountain-boundary, there are many nonidentical material objects that massively overlap with *a* and that have more or less the same mountain-shape and mountain-boundary as *a*. Accordingly, any material object that is a subject of an m-state massively overlaps many other material objects that are also subjects of m-states with more or less the same intrinsic and realization profiles. This holds for K-states in general. I shall say that when distinct K-states, for the same K, obtaining at the same time are that similar, then they are *superimposed*.

Next, let me introduce the notion of *hosting*. For any K-state *s*, such that a composite material object *a* is either the subject of *s* or has a proper part that is the subject of *s*, *a hosts s*. The relation of hosting between a complex material object and multiple K-states is less intimate than the instantiation relation. But hosting is far from arbitrary. For all the K-states hosted by a material object lie within the object's spatial boundary. While not strictly the subject, the material object is the "site" of these superimposed K-states.

Furthermore, for any range of massively overlapping material subjects of superimposed K-states—call these objects *K-objects*—there is, by the principle of merelogical universalism, the fusion of all the massively overlapping K-objects—call this maximal fusion a *K-plus-object*. A K-plus-object hosts a plurality of superimposed K-states. In fact, a K-plus-object is the site of a maximal cluster of superimposed K-states.

With these assumptions about K-states and material objects in place, I shall characterize an *ordinary object* of kind K as a K-plus-object—that is, as a maximal fusion of massively overlapping K-objects. Maximality constraints are familiar from the literature on ordinary sortal concepts.[12] It has been pointed out that ordinary sortals are naturally construed as maximal, in the sense that if an object is a mountain, for example, then it lacks any large proper parts that are mountains. This intuitively plausible principle stands behind my appeal to maximality in the ontological analysis of mountains and other ordinary objects. Assuming that any mountain-object and any fusion of massively overlapping mountain-objects is a candidate for being a mountain, it follows by this principle that only the maximal fusion of massively overlapping mountain-objects is a mountain. (I shall return to maximality in §2.3.)

An ordinary object of kind K hosts a plurality of superimposed K-states. All of these K-states lie within the material boundary of the object. In a hylomorphic spirit, I shall characterize a K-state hosted by an object of kind K as an *individual form* of that object. Ordinary objects are thus construed as having multiple individual forms. The multiple m-states hosted by a mountain are individual forms of this mountain. An m-state is a form of a mountain because it contains properties that realize mountainhood; and it is an individual form of a mountain because it is localized, a distribution of facts across a particular region of space (at a time). Notice that these different individual forms of an ordinary object do not reflect joints in nature: they are not needed to unify the parts of objects, which is a function forms are required to perform on Aristotelian conceptions. On an Aristotelian conception, an ordinary

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[12] See, *inter alia*, Sider 2001, 2003.

object could not have multiple forms. The point of the present multiplication of forms is a very different one.[13]

2.2 Mereological indeterminacy *de re* as variation among forms

Having paired ordinary objects with multitudes of individual forms, let us turn to ordinary statements of mereological indeterminacy about such objects. It is indeterminate whether mountain M has rock *r* as a part (at *t*). We saw in §1 that the standard multiple-candidates-based *de dicto* account of this claim, according to which the indeterminate mereological boundary of M derives from the imprecision of the sortal concept *mountain*, gets bogged down by the problem of the many. In the hope of making progress with this difficulty, the mereological indeterminacy of M could instead be construed as *de re* and as arising independently of imprecision of sortal or other representations of objects. Instead of viewing the name 'M' as referring imprecisely to multiple, precise objects, the name could be viewed as referring precisely to a unique, vague object. On the *de re* reading, it is indeterminate of M whether: it has rock *r* as a part (at *t*), where it is indeterminate of M whether: it has *r* as a part just in case it is neither determinate of M that: it has *r* as a part nor determinate of M that: it does not have *r* as a part. While ordinary mereological indeterminacy *de re* is usually understood as fundamental, I shall aim to avoid such a heavy metaphysical commitment and sketch an account of ordinary mereological indeterminacy *de re* as merely derivative.[14] It must be emphasized that the account is not meant to apply to all instances of indeterminacy. It is confined to familiar claims of mereological indeterminacy about ordinary objects, such as the claim about M.[15]

Given that ordinary objects have multiple individual forms, mereological indeterminacy of an ordinary object is grounded in the multitude of the object's superimposed individual forms in the following way. An individual form of an ordinary object *o*—a K-state, for some kind K, hosted by *o*—is a complex fact, and hence contains properties. Among those properties are mereological properties, such as having *x* as a part, for some material object *x*. The facts that underlie or ground the truth of statements of mereological determinacy and indeterminacy *de re* about ordinary objects are facts concerning which mereological properties are contained in which of the object's many superimposed individual forms. The matching mereological properties of an object *o*'s individual forms, those all individual forms contain, are *o*'s determinate mereological properties. The differing mereological properties of *o*'s individual forms, those some but not all individual forms contain, are *o*'s indeterminate mereological properties. For any ordinary object *o* and any material object *x*,

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[13] See Koslicki 2008 on Aristotelian and neo-Aristotelian hylomorphism about ordinary objects.

[14] What follows is a very rough outline of the account. For further details, see Sattig forthcoming a and forthcoming b.

[15] It is not even clear that the account applies to all instances of mereological indeterminacy. There may well be mereological cases that are best understood as *de dicto*.

(MI)

It is determinate of o that: it has x as a part iff each of o's individual forms contains the property of having x as a part.

It is determinate of o that: it does not have x as a part iff none of o's individual forms contains the property of having x as a part.

It is indeterminate of o whether: it has x as a part iff some but not all of o's individual forms contain the property of having x as a part.

This account renders mereological indeterminacy *de re* nonfundamental, or derivative, in the sense that facts about such indeterminacy are grounded in more basic, indeterminacy-free facts about superimposed K-states, and in the sense that superimposed K-states, the individual forms of ordinary objects, do not, unlike Aristotelian forms, carve nature at the joints. The proposed type of mereological indeterminacy *de re* doesn't run deep. Those who oppose fundamental indeterminacy on the grounds that a picture of reality as having multiple precisifications is unacceptably radical, yet see a need to recognize vague objects, should welcome an account of indeterminacy *de re* as arising from a perfectly precise reality, as orthodoxy conceives of it.

It is, further, obvious that the present account of mereological indeterminacy, while being a *de re* account, is structurally similar to the supervaluationist *de dicto* account of mereological indeterminacy. The standard suparvaluationist account of 'It is indeterminate whether: o has x as a part' supervaluates over the different candidate referents of 'o' (see §1). The present account of 'It is indeterminate of o whether: it has x as a part' supervaluates over the different individual forms of o—that is, over the different K-states, for some kind K, hosted by o. Supervaluation over multiple candidates is replaced by supervaluation over multiple forms of a single candidate.

With a rough sketch of the framework in place, let us employ it in specifying a metaphysical basis of the true statement that it is indeterminate of M whether: it has r as a part. We assumed earlier that material objects are fundamentally clear-cut, and hence that it is fundamentally determinate of material objects which things they are composed of. In the case under discussion, there is a mountain-plus-object that massively overlaps with many mountain-objects—call one of these aggregates of rocks 'A'—and that, accordingly, hosts a cluster of superimposed m-states. By the ontology of ordinary objects stated above, the mountain-plus-object is a mountain— let it be M—that hosts a cluster of superimposed m-states, its individual forms. These individual forms are distributions of fundamentally determinate facts across clear-cut material objects, namely, M and proper parts of M.

Let us assume, next, that one individual form of M includes the fact that M is composed of the xs, whereas another individual form of M includes the fact that A, a proper part of M, is composed of the ys, where the xs and the ys are distinct but overlap massively, in that rock r is one of the xs but not of the ys.[16] As a consequence

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[16] For ease of exposition, I am here treating the properties of being composed of the xs and of having r as a part as complex monadic properties, ignoring individual forms of the xs and

of the foregoing specifications, M's multiple individual forms differ with respect to which mereological properties they contain. By truth conditions (MI) of statements of mereological indeterminacy *de re*, it is indeterminate of M whether: it is composed of the *x*s or of the *y*s. In particular, it is indeterminate of M whether: it has *r* as a part.

Notice that a mountain may be mereologically fuzzy even if the sortal *mountain* is perfectly precise; the sortal is not the source of all ordinary mereological indeterminacy. For the differences between superimposed m-states may be *subsortal* differences; they need not correspond to differences between admissible precisifications of the sortal. What holds for mountains holds for other ordinary objects. Their indeterminate boundaries are derivative, the result of potentially subsortal differences among their many superimposed forms, floating above the clear-cut boundaries of their underlying matter.[17]

2.3   Maximality and the problem of the many

How can the problem of the many be solved on the basis of the proposed account of mereological indeterminacy *de re*? We saw that the standard supervaluationist approach to view all mereological indeterminacy of ordinary objects as indeterminacy *de dicto* deriving from the imprecision of sortal concepts has a hard time dealing with the problem of the many. That it is indeterminate whether mountain M has rock *r* as a part does not have its source in the fact that 'M' has different candidate referents, which are distinguished by different precisifications of *mountain*, such that some include *r* and some exclude *r*. For the differences between the various candidates are much more fine-grained than the differences between any sensible and principled precisifications of the sortal—the differences are subsortal. And this has the consequence that there are either many mountains or none where we thought there was just one.

If the mereological indeterminacy of mountains is based on small mereological differences between multiple, fundamentally precise aggregates of rocks, then it is difficult to sustain our intuitive claim that there is exactly one mountain on the plain. If, on the other hand, mountains are allowed to be vague objects, then the way is clear for cutting down the mountains on the plain to a single one and attributing a mereologically indeterminate boundary to it. On the present account, this indeterminate boundary is grounded in the multiplicity of the mountain's superimposed individual forms and their varying mereological properties. Supervaluation over multiple candidates is replaced by supervaluation over multiple individual forms of a single candidate.

But the job isn't done yet. For the question remains as to what grounds the fact that there is exactly one vague mountain on the plain, as opposed to many. Mountain M is a material object that hosts a cluster of superimposed m-states, its individual forms. These differ with respect to which mereological properties they

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of *r*. Ultimately, the framework should be able to handle relational formal predications of parthood that are sensitive to the individual forms of all of its relata.

[17] For another derivative account of mereological indeterminacy *de re*, developed in the context of a relative-identity solution to the problem of the many, see Sattig 2010.

contain. While M has rock *r* as a part, fundamentally speaking, some of its individual forms contain the property of having *r* as a part, and others don't. So it is indeterminate of M whether: it has *r* as a part, derivatively speaking. Now consider a large proper part of M, say, the material object that, fundamentally speaking, is composed of all of M except for *r*. Call this material object 'M-*r*'. M-*r* also hosts a cluster of m-states, and is thus mereologically indeterminate. If M-*r* is another vague mountain, in addition to M, then, once again, there are too many mountains. If, on the other hand, M-*r* is not a mountain, then which mountain-determining properties does M have that M-*r* lacks? We have an explanation of what makes M mereologically indeterminate. But what explains its uniqueness? This is the problem of the many as it arises within the present framework.

What explains M's uniqueness is a maximality requirement on mountainhood: only *maximal* fusions of massively overlapping mountain-objects are mountains—that is, only mountain-*plus*-objects are mountains. This is an instance of the general principle that an ordinary object of kind K is a K-plus-object. Recall from §2.1 that this maximality requirement is motivated by linguistic intuitions about ordinary sortal concepts. Now, why is M a mountain, but not M-*r*? M is a mountain, because it is a maximal fusion of massively overlapping mountain-objects—a mountain-plus-object. M-*r*, however, is not a mountain, because it is not a maximal fusion of massively overlapping mountain-objects—it is not a mountain-plus-object. Second, why is there exactly one mountain on the plain? On the plain we find a range of massively overlapping material objects, each of which is a subject of a different m-state—they are overlapping mountain-objects. By the principle of mereological universalism, there is a maximal fusion of these massively overlapping mountain-objects. By the principle of extensionality, there is a unique such maximal fusion.[18] So there is only one mountain on the plain, because there is only one maximal mountain-object out there. It is important that maximality constitutes a *principled* way of singling out one mountain from a range of massively overlapping candidates. By contrast, the standard supervaluationist proposal is to single out a mountain *arbitrarily* or else recognize many mountains.

Let me add a point of clarification. The principle that an object of kind K is a maximal fusion of a plurality of massively overlapping K-objects is not to be confused with the principle that an object of kind K is a maximal K-object—that is, a K-object that is not a part of any slightly larger K-object. Suppose that a kind K is partially defined by the property of having exactly *n* electrons as parts.[19] Suppose, further, that in a given location there is exactly one object of that kind, and that while this object determinately has *n* electrons, it is indeterminate which electrons these are. There are, say, electrons e_1 and e_2 on the object's surface, such that it is indeterminate whether it has e_1 as a part and indeterminate whether it has e_2 as a part, but determinate that it does not have both e_1 and e_2 as parts. How can this be true? Assume that there is a cluster of nonidentical but massively overlapping composites, such that each has exactly *n* electrons as well as other properties that jointly realize K-hood. They are all K-objects. However, the fusion of all of these composites has

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[18] For a more elaborate characterization of the role of these classical-mereological assumptions in the proposed ontology of ordinary objects, see Sattig forthcoming b.
[19] Thanks to Robbie Williams here.

more than *n* electrons, and hence does not realize K. Now, if an object of kind K is understood as a maximal K-object, then there is no unique object of kind K in the given location, since there is no unique maximal K-object there. This difficulty is avoided, if an object of kind K is understood as a maximal fusion of a plurality of massively overlapping K-objects. For such a fusion need not be a K-object itself. In the case at hand, there is a unique object of kind K in the given location, just as expected, since there is a unique maximal fusion of the massively overlapping composites, each of with has *n* electrons. That this K-plus-object does not itself realize K-hood—it does not have exactly *n* electrons—is irrelevant. To repeat, what makes a material object an instance of a kind K, on the present account, is not that it is a maximal K-realizing object. What makes it an instance of that kind is rather that it is the fusion of all massively overlapping K-realizing objects, whether or not it realizes K itself.

I conclude that the present account of ordinary objects and of our familiar ascriptions of indeterminate boundaries to ordinary objects sustains our common practice of counting these objects. There is exactly one mountain on the plain, while it is indeterminate of this mountain which rocks it is composed of. Maximality explains the mountain's uniqueness. Plurality of individual forms explains the mountain's indeterminate boundary. This solution to the problem of the many, based on a *de re* account of mereological indeterminacy, is superior to the standard solution based on a supervaluationist *de dicto* account of mereological indeterminacy in that it captures our cardinality claims about mountains without turning mountainhood into a fundamental property. Moreover, the proposed solution is superior to any solution based on the standard *de re* account of mereological indeterminacy in at least the respect that it captures our mereological indeterminacy claims without viewing such indeterminacy as being a fundamental feature of reality.

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