

Gunk Mountains: A Puzzle

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Abstract

This note points out a conflict between some common intuitions about metaphysical possibility. On the one hand, it is appealing to deny that there are robust counterfactuals about how various physically impossible substances would interact with the matter that exists at our world. On the other hand, our intuitions about how concepts like MOUNTAIN apply at other metaphysically possible worlds seem to presuppose facts about ‘solidity’ which cash out in terms of these counterfactuals. I consider several simple attempts to resolve this conflict and note they all fall short.

1 Introduction

This note aims to point out a conflict between some common intuitions about metaphysical possibility.

In the first half of this paper I will point out that three robustly attractive intuitions about metaphysical possibility are incompatible with one another. On the one hand, it is appealing to deny that there are robust counterfactuals about how various physically impossible substances would interact with the matter that exists at our world. But, on the other hand, our intuitions about how concepts like MOUNTAIN would apply at other metaphysically possible worlds seem to presuppose facts about ‘solidity’ which seem to need to be cashed out

in terms of these counterfactuals. I consider several simple attempts to resolve this conflict, and note they all fall short.

In the second half of this paper, I will provide further motivation for (what might otherwise seem like) the least compelling of the above principles. Specifically I will argue that positing definite *de re* counterfactuals about interactions between objects in metaphysically possible worlds very alien to one another (and the attempting to develop this idea in a principled way), leads to a cardinality paradox.

2 A Puzzle About Mountains

In [4] David Lewis introduces the idea of ‘gunk’, a kind of matter which is indefinitely divisible. We can use this notion to bring out a tension in common ways of thinking about metaphysical possibility as follows.

Intuition 1 It is metaphysically possible for there to be a mountain made of gunk in a world containing only gunk.

Intuition 2 If something isn’t disposed to resist the motion of *our* hands, then it doesn’t count as a mountain, e.g., a mountain shaped cloud doesn’t qualify as a mountain.

Intuition 3 There is no fact about whether our hands (made of atoms) would be repelled by gunk existing at in an all gunk world.

The tension between these three premises is clear. Intuition 1 insists that there is a possible world containing a gunk mountain, but Intuitions 2 and 3 imply that it can’t be determinately true that the proposed world contains a gunk mountain.

To dramatize the difficulty of solving this puzzle, I will consider some possible ways of responding to it. I will argue that significant sacrifice and/or philosophical work would be required to adopt any of them one.

I don't think Intuition 1 is particularly controversial, so let's begin by considering the costs of rejecting Intuition 2. It's hard to deny that mountain shaped clouds in our world do not (literally) count as mountains¹, and (I will argue) we seem to need Intuition 2 to explain this fact.

Consider the alternatives. We might say that being a mountain requires being disposed to resist the touch of (and otherwise play a mountain-role towards) some *possible agents*. But this condition is too weak to do the necessary work, since there could (presumably) be cloudy agents who would be repelled by the mountain-shaped clouds in our world. On the other hand, saying that mountainhood requires that some agents *in the world containing a purported mountain* would be impeded is obviously too strong. For, surely, there can be universes with mountains but no agents.

Instead we might say that an object in a possible world w can only qualify as a mountain if it's disposed to repel *some of the agents living in w if there are any* – or to repel (in some sense) most of the 'material' in w . But these requirements are both too weak, as we can see by considering a possible world closely mirroring our own, but with the addition of cloud people (or dark matter people) who ski on cloud (dark matter) mountains. Even if the cloud stuff in this world acts like a solid with respect to other cloud stuff, and even if there is more cloud stuff in this world than atomic stuff, it seems intuitively clear that as long as *our* hands would effortlessly pass through a mountain shaped cloud, it wouldn't qualify as a mountain.

And we can't say that mountainhood requires being disposed to repel *all*

¹We might speak metaphorically about mountains of coins which Scrooge McDuck can swim in or mountains of spices. But we would not count these when asking how many mountains the world contains.

agents in your world, because this requirement is too strong. Surely discovering the existence of ghostly agents who could pass through Mt. Everest wouldn't stop us from counting it as a mountain. So it looks like Intuition 2 can't be given up easily.

Now let's turn to Intuition 3, which denies that there are definite counterfactuals about whether our hands (made of atoms) would be repelled by gunk existing in an all gunk world. Rejecting Intuition 3 raises a question: what about our world and/or an all gunk world could ground such *de re* counterfactuals about interaction dispositions?

For note that neither our world, $w_{\textcircled{a}}$, nor any possible all-gunk world, w_1 , contains both types of matter (gunk and atoms). Either hypothesis (resist vs. pass through) about what would happen if we tried to touch stuff in w_1 seems to fit equally well with the pattern of events within both w_1 and $w_{\textcircled{a}}$. Thus (plausibly) no **scientifically discernable pattern** in the events in $w_{\textcircled{a}}$ or w_1 can ground counterfactuals about the interaction of material from $w_{\textcircled{a}}$ with material in w_1 .

Additionally, accepting such definite *de re* interaction counterfactuals creates pressure to posit multiple deeply (structurally and nomically) similar all-gunk worlds which differ only in how objects within them are disposed to interact with specific forms of alien matter. For if we accept the existence of a possible world w_1 containing gunk peaks disposed to resist our hands, then it seems that (on pain of arbitrariness) we should also accept a structurally identical possible world w_0 containing gunk peaks disposed to let our hands pass through. For hand-permeable gunk seems just as conceivable as hand-resisting gunk. And saying w_1 exists but not w_0 makes the space of possible worlds seem deeply arbitrary.

So we seem forced to posit a pair of worlds w_1 and w_0 , with the following

features. The internal structure and pattern of events taking place with w_1 and w_0 are exactly the same. But in the closest world where (a counterpart of) you tries to climb (a counterpart of) the mountain in w_1 , you succeed. And in the closest world where (a counterpart of) you tries to climb (a counterpart of) the mountain in w_0 , you (sink through the mountain-shaped peak and thereby) fail.

Now we can take this difference in the counterfactual behavior of gunk in w_0 and w_1 to be fundamental, or take it to be grounded in some intrinsic ‘non-structural’ feature² that differentiates w_0 from w_1 . For example, one might say that the chunks of gunk in w_0 and w_1 have **different essences** ($gunk_0$ or $gunk_1$), which explain their different dispositions to interact with us. But, in either case, we are positing an extra, deeply scientifically undetectable, fact which distinguishes between w_0 and w_1 – something which strikes many philosophers as deeply undesirable³. Thus rejecting Intuition 3 is also hard.

3 Essences to the Rescue?

In view of the motivations above, accepting Intuition 3 might seem like the easiest way to avoid paradox. But I will now argue that, if we take this route, the same considerations which lead us to introduce the gunk worlds w_1 and w_0

²By this I mean, some difference between w_0 and w_1 which is compatible with their both involving the same pattern of gunk distributed through space and time.

³For example Hawthorne writes, “The best case for thinking that the causal profile of a property exhausts its nature proceeds not via the thought ‘Well otherwise we wouldn’t know a whole lot of what we do know’ but rather via the thought ‘We don’t need quidditative extras in order to make sense of the world.’ Let us return to negative charge. All scientific knowledge about negative charge is knowledge about the causal role it plays. Science seems to offer no conception of negative charge as something over and above ‘the thing that plays the charge role.’ If there were a quiddity that were, so to speak, the role filler, it would not be something that science had any direct cognitive access to, except via the reference fixer ‘the quiddity that actually plays the charge role.’ Why invoke what you don’t need? Unless certain logical considerations forced one to suppose that properties are individuated by something over and above their causal role, then why posit mysterious quiddities?” [2]. Perhaps one could take the gunk mountain problem to point out a way in which (rather than logical considerations) natural language, core metaphysical possibility intuitions and non-arbitrariness considerations ‘force’ one to posit quiddities.

lead to an explosion of essences and, perhaps, paradox. I'll phrase my point in terms of essences, but a similar argument can be made for other ways of grounding the difference between w_0 and w_1 .

Let 'repels(a,b)' abbreviate the claim that things with essence a are disposed to resist things with essence b . As we argued above, if there's a $gunk_1$ s.t. $\text{repels}(atoms_{\textcircled{a}}, gunk_1)$ then there should also be a $gunk_0$ such that $\neg\text{repels}(atoms_{\textcircled{a}}, gunk_0)$. But unless something special about $atoms_{\textcircled{a}}$ or the actual world is being invoked here (see below) it would seem that, by the same token, there should also be multiple atom-type essences grounding different possible dispositions to interact with $gunk_1$ and $gunk_2$?

For example, even though $atoms_{\textcircled{a}}$ pass through $gunk_0$, it would seem that there should also be another atom-type essence $atom_1$ which grounds a disposition to obey all the scientifically discoverable laws that govern atoms in our world and resist penetration by $gunk_0$. Indeed, it seems that any possible way (repels, or \neg repels) of interacting with $gunk_1$ and $gunk_0$ should be realized by some atom-type essence. Thus it seems like we should have atom-type essences corresponding to all all $2^2 = 4$ options, i.e., we should have the following essences.

- $atom_{\textcircled{a}}$ s.t. $\text{repels}(atoms_{\textcircled{a}}, gunk_1) \wedge \neg\text{repels}(e_{\textcircled{a}}, gunk_0)$
- $atom_1$ s.t. $\neg\text{repels}(atom_2, gunk_1) \wedge \text{repels}(atom_2, gunk_0)$
- $atom_2$ s.t. $\text{repels}(atom_3, gunk_1) \wedge \text{repels}(atom_3, gunk_0)$
- $atom_3$ s.t. $\neg\text{repels}(atom_4, gunk_1) \wedge \neg\text{repels}(atom_4, gunk_0)$.

But then, by the same reasoning applied to possible ways gunk worlds could relate to these 4 atom worlds, it seems there should be at least $2^4 = 16$ distinct kinds of gunk type essences (including $gunk_1$ and $gunk_2$) corresponding to different possible relationships to $atom_{\textcircled{a}}, atom_1, atom_2, atom_3$. And so on.

By iterating this argument we see that there must be a countable infinity of different atom-type and gunk-type essences.

In itself, this would not be so bad. But it gets much worse. For it's not clear how we can avoid the following, inconsistent, doctrine in any principled way:

Full Plenitude Thesis: For any set S of essences playing the gunk (atom) role and function f from S to a set of possible interaction dispositions (e.g., to resist or not resist penetration), there is an essence e playing the atom (gunk) role such that e has interaction disposition $f(i)$ with any $i \in S$

To see that this principle is incoherent, let α be the cardinality of gunk-type essences. Then (by the principle above) the atom-type essences must have cardinality at least 2^α . But then (by the same principle) there must be at least $2^{2^\alpha} \neq \alpha$ gunk-type essences. This is a contradiction⁴.

Now we can weaken the above Full Plenitude Principle by limiting the size of the sets of essences considered to be less than some cardinality κ . Of these options, perhaps $\kappa = \omega$ is most attractive (i.e., the saying that the above plenitude principle only holds for finite sets of essences). But making any choice seems unprincipled.

Alternately, one can try to avoid this problem by metaphysically privileging the actual world. One could say that all objects at other possible worlds definitely have (or lack) a property like 'solidity' which grounds definite counterfactual facts about their disposition to repel the atoms that make up the actual world, but then *deny* that there are analogously well defined facts

⁴Note that this cardinality problem for *essences* is different from Forrest and Armstrong's cardinality problem for *possible worlds* and Kaplan's cardinality problem for *propositions* which Lewis considers in 2.2 and 2.3 of [5], and it can't be avoided by just endorsing the constraints on what propositions it is metaphysically possible to express, and when (so to speak) some collection of possible worlds can be combined to form a larger one, which Lewis advocates there.

about how objects at *arbitrary* pairs of possible worlds are disposed to interact with one another. However, adopting this view involves some bullet biting. It would require that we reject some intuitive verdicts about the truth conditions of people’s use of “mountain” at macroscopically identical worlds made of some non-gunk-type substance different than our fundamental particles. For consider people living in these worlds (containing some radically different third type of metaphysically possible substance). It would seem that the proposition expressed when they say, “there could be a gunk mountain in an all gunk world” could not be (definitely) true, because (we would be conceding that) there are aren’t definite counterfactuals governing their bodies interaction with radically different metaphysically possible substances (such as gunk)⁵.

4 Conclusion

In this note I have tried to draw attention to a conflict between various common intuitions about metaphysical possibility. On the one hand, it appears that there could be mountains in possible worlds with radically different physical fundamentalia from our own (e.g., gunk mountains in all gunk worlds) and that being a mountain requires having robust dispositions to interact with actual human bodies in certain ways. But, on the other hand, it is hard to imagine plausible grounds for such robust *de re* counterfactuals about interactions between objects from such radically different possible worlds. Indeed, even if we bite the bullet of rejecting the possibility of gunk mountains and accept a plenitude of

⁵Another strategy for rejecting premise 3, while avoiding this problem, would be to say that the existence of a single possible world can somehow ground the truth of two incompatible claims about metaphysical possibility, just as David Lewis holds a single possible world can witness the possibility of my being one twin or another[5]. In this case, we would say that a single metaphysically possible world accounts for both possibility of there being gunk which would resist our hand and gunk which wouldn’t resist our hands. Perhaps if one does this, one can avoid the idea that there must be different gunk-type essences whose different natures explain the disposition to interact with atomic matter, and thus cut proliferation problems off even earlier. But it is, at best, extremely unclear how this proposal could be developed – even from a technical point of view.

essences with different hidden scientifically undetectable natures grounding such counterfactuals, we are forced to choose between arbitrariness and incoherence when deciding how many different such essences to posit.

I won't discuss possible solutions to this puzzle here. But I think looking for such solutions is a valuable task for any friend of contemporary analytic metaphysics, because this puzzle threatens to reveal deep incoherence in a common package of assumptions and intuitions about metaphysical possibility. Also note that, if my arguments for Intuition 2 succeed, they suggest that many ordinary-language concepts involve a kind of (hitherto unnoticed) 'implicit rigidified reference' to the actual world. It has long been noted that 'water' applies to what is chemically similar to *the watery stuff* around here [3]. But, if Intuition 2 is correct then "mountain" (and presumably many other such ordinary-language macroscopic-object terms) will apply only to things that would resist penetration by the stuff that makes up *our* bodies. Thus, in David Chalmers' vocabulary, many more things will be 'twin earthable' than had previously been recognized⁶.

References

- [1] David J. Chalmers. *Constructing the World*. Oxford University Press UK, 2012.
- [2] John Hawthorne. Causal structuralism. In James Tomberlin, editor, *Metaphysics*, pages 361–78. Blackwell, 2002.

⁶As Chalmers puts it, "an expression E is Twin-Earthable if there can be a non-deferential utterances of E for which there is a possible corresponding utterance by a twin speaker with a different extension. So 'water' is Twin-Earthable since a non-deferential utterance of 'water' by Oscar (on Earth) may refer to H_2O while a corresponding non-deferential utterance by his twin Twin Oscar (on Twin Earth) may refer to XYZ. By contrast, 'zero' is not Twin-Earthable: while Burge's arguments suggest that twins in different linguistic communities might use 'zero' with different extensions, this requires that the utterances be deferential." [1].

- [3] Saul Kripke. *Naming and Necessity*. Blackwell, 1972.
- [4] D. K. Lewis. *Parts of Classes*. B. Blackwell, 1991.
- [5] David K. Lewis. *On the Plurality of Worlds*. Blackwell Publishers, 1986.