Gunk Mountain Puzzle Handout

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Background/ personal trivia:

I was (as usual) working on a big positive project in philosophy of mathematics[1] when I kept finding myself blocked by this puzzle.

Since I think it's (basically) a problem for everyone I'm giving this presentation in hopes of crowdsourcing a solution. So I'd love to hear about any ideas that occur to you after the talk at seberry@invariant.org.

I. The main puzzle

Intuition 1 It is metaphysically possible for there to be a mountain made of gunk in a world containing only gunk[2].

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 in an all gunk world.

Let's consider each intuition in turn.

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

By normal ways of thinking about metaphysical possibility and the relationship between conceivability and possibility it seems fairly plausible that we could have a world that is macroscopically like ours but made of gunk.

[1] In this case, developing the seductive slogan that "our knowledge of foundational existence claims about mathematics is a 'limit case' of our knowledge of ontologically inflationary conditionals about ordinary objects like holes and shadows and mereological fusions of atoms and sociological objects like countries, e.g., 'if matter is doing this there's a hole' 'if people are doing this there's a country"'

[2] By 'gunk' I mean homogeneous infinitely divisible matter.

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.

The focus on *our* hands might seem a little bit weird e.g., Intuition 2 seems to imply that many more things are 'twin-earthable' (i.e. there can be a non-deferential use of the term for which there's a possible corresponding utterance by a 'twin' speaker with a different extension[3]) than is usually thought.

But it is hard to to explains why clouds (or other insubstantial matter) in our world cannot not (literally) count as mountains without it. For example we might try to say...

- some agents exist in the world containing the purported mountain and would be impeded by it.
  - But, surely, there are possible worlds which don't contain anything we would recognize as an agent, but still contain mountains
- some/most agents (if there are any) in the same world as the candidate mountain would be impeded by it. [or: some/most agents in the closest possible world to that containing the candidate mountain would be impeded by it.]
  - If the actual world turned out to contain cloudy agents made of some special kind of cloudy matter which was more prevalent than solid stuff in the actual world, 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.
- all agents (if there are any) in the same world as the candidate mountain would be impeded by it.
  - If there turned out to be ghosts which could pass through rock, this wouldn't prevent what we think of as mountains from qualifying as mountains.

So it's hard to see how to reject Intuition 2 while maintaining common intuitions about the cases above.

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.

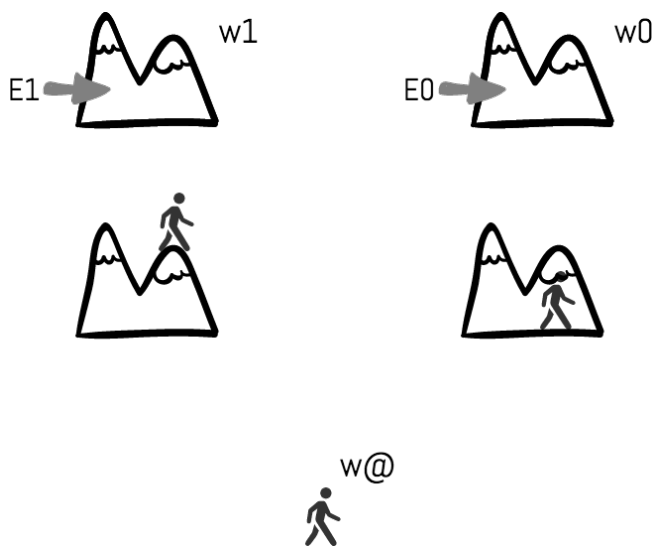
[3] As Chalmers further explains, " So 'water' is Twin-Earthable since a nondeferential utterance of 'water' by Oscar (on Earth) may refer to H_2O while a corresponding nondeferential utterance by his twin Twin Oscar (on Twin Earth) may refer to XYZ. By contrast, 'zero' is not Twin-Earthable: while Burge's arguments suggest that twins in different linguistic communities might use 'zero' with different extensions, this requires that the utterances be deferential." [**?**].

Suppose we accept Intuition 1 and 2 and say there's a w_1 containing gunk mountains.

Then, we probably also want to say there's also a w_0 containing mountain-shaped gunk which our hands would be disposed to pass through, because:

- such insubstantial gunk filled worlds seem just as conceivable as gunk mountain worlds
- a kind of humean recombination motivates accepting such a w_0 e.g. nothing about the idea of infinite divisibility seems to preclude either a disposition to resist or block our hands
- saying it's possible for there to be gunk disposed to to resist our hand but not gunk disposed to let our hands pass through seems **arbitrary**.

So we get the following situation[4]:



But then it seems like there should be some fact about the nature of w_a and w_1/w_0 which explains this counterfactual difference in how our hand would interact with the objects in them. What could this difference be?

We are forced to posit some kind of 'hidden' scientifically undetectable fact about the essence E_1 of the gunk at w_1 (or whatever grounds facts about the objects in w_1s counterfacutal disposition to interact with us) – a thing which many philosophers have considered undesirable.

- for (we can easily imagine the scenario so that) the scientific laws within w1 and w0 might be exactly symmetrical, with precisely analogous principles

[4]Figure made with Logomakr.com

determining how objects with E_1/E_0 interact with themselves and objects with other physically natural differences.

- in this case fundamental difference between E_1 and E_0 which explains why objects made of gunk satisifying E_1 can form mountains while those made of E_0 cannot, will be something extra over and above all the (shared) facts about E_1 and E_0 which denizens of these worlds could in principle learn.

- since it is (presumably) physically impossible in all-gunk worlds w_1 and w_0 for anything like the kind of matter that makes us up to exist, it plausible that (could the denizens of these worlds refer to our world and know everything scientifically discoverable about its laws) either hypothesis about what would happen if we tried to touch the peaks of w_0/w_1 would be equally well motivated by the (shared) observed behavior of stuff in w_0/w_1

Presumably one will want to think about the different counterfactual behavior of stuff in w_0 and w_1 as grounded in something intrinsic to these worlds

- e.g. distinct essences E_0/E_1 instantiated by the gunk at w_0/w_1, whose different nature ensures/explains the different dispositions of mountain shaped objects in w_0/w_1 to interact with us.

- For concreteness I will assume that there are such essences in articulating the further problem below, but I think an analogous problem arises however we think about the above counterfactual dispositions being grounded.

II. Bonus Cardinality Problem

Suppose we bite the bullet re: intuition 3 and accept intuitions 1 and 2 in the manner indicated above. A further problem arises.

For the intuitive idea that can posit an all gunk world w1 whose peaks have some essence e_1 which makes them disposed to resist our hands without arbitrariness, by simultaniously positing a w_0 containing gunk whose essence e_0 grounded the opposite behavior turns out to lead to a massive proliferation of essences as follows...

First, consider the following reasoning about how many different types of gunk (aka essences compatible with satisfying the gunk axioms at some possible world) and a countable infinity of different types of atoms (aka essences compatible with playing the atom role at some possible world)[5]

- There is at least one atom-type essence, namely the essence had by atoms in the actual world. Call this essence $e_{@}$. There are two incompatible ways which an object with a gunk type essence can interact with objects instantiating another essence: resisting it and not resisting it.

[5] I will assume that the types of gunk and they types of atoms are disjoint, so no essence can belong to both.

- So there are two distinct gunk type essences (call them $y_1 y_2$), such that $\text{repels}(e_@, y_1) \wedge \neg\text{repels}(e_@, y_2)$ if we use 'repels' to abbreviate 'things with essence x1 are disposed to resist things with essence x2'.
- So there are at least four distinct types atom type essences corresponding to different possible relationships to these witnesses y_1 and y_2: $\text{repels}(e_@, y_1) \wedge \neg\text{repels}(e_@, y_2)$, $\text{repels}(x_2, y_1) \wedge \text{repels}(x_2, y_2)$, $\neg\text{repels}(x_3, y_1) \wedge \text{repels}(x_3, y_2)$, $\neg\text{repels}(x_4, y_1) \wedge \neg\text{repels}(x_4, y_2)$.
- So there are at least eight distinct kinds of gunk type essences corresponding to different possible relationships to $e_@, x_2, x_3, x_4$.
- etc.

So adopting the above strategy for positing definite interaction dispositions but avoiding arbitrariness seems to commit us to at least a countable infinity of different essences of each type.

In itself maybe this is not so bad. But the things get worse. For the underlying intuition that let us infer the existence of multiple types of gunk is would seem to be most naturally formulated something like as follows.

- **Full Plenitude Principle**: 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 interpenetration, both disappear, both explode), there is an essence e playing the atom (gunk) role such that e has interaction disposition $f(i)$ with any $i \in S$

And this yields a contradiction. If the different types of gunk have cardinality α, then this principle implies that the types atoms must have cardinality 2^α. But then applying this principle again says there must be $2^{2^\alpha} \neq \alpha$ types of gunk. Contradiction[6]

Help via privledging 'solidity' facts that relate things to the actual world?: One can avoid the above cardinality problem by saying that objects at arbitrary possible worlds have a property like "solidity" which grounds definite counterfactuals about their interaction with *the stuff that makes up the actual world* but not other metaphysically possible stuff.

- But then we must admit that 'twin' utterances about the possibility of a gunk "mountain" in very physically different worlds could not be (definitely) true, because (we would be conceding that) there are no definite counterfactuals relating *their* hands to mountain-shaped things in other metaphysically possible worlds

[6]Note 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 [**?**], and not fixed by just endorsing the constraints 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.