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Common origins and the ethics of planetary seeding

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Abstract: Faced with a choice between attempting to seed another world with terrestrially-sourced microbes (with which we would have a shared origin) and microbes sourced from elsewhere within the solar system (whose origins might therefore differ), would we have any non-instrumental ethical reason to favour the terrestrial microbes? What follows will argue that in relation to the goals of promoting life similar to our own, or even simply microbial life, we might conceivably make such an appeal and do so in a defensible manner. However, in no case would such a consideration operate as a silencer for rival considerations (such as likelihood of success, enhancing diversity or historical justice). The thought experiment serves to highlight the diversity of considerations which are in play in ethical deliberation about matters of astrobiology and the role of practical wisdom rather than trumping considerations.

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As a thought experiment, let us suppose that the formidable technical obstacles which stand in the way of planetary seeding (directed panspermia) can be overcome (Genta & Rycroft 2003; Milligan 2015). Let us suppose that the ethical problems can also be overcome by, for example, sending microbes only to places where we think that a planet might have recently formed by the rendezvous time. In this way we might minimize the dangers of harm to any indigenous life (Persson 2014). On the additional assumption that we ought to go ahead with planetary seeding, would it matter *where* the microbes came from? More specifically, under circumstances where we have access to microbial life with which we are known to share a common origin, and microbial life about which we have no such knowledge, should we favour sending the former rather than the latter? This would seem to be implied by a position, which is sometimes known as 'originism', exemplified by Mautner (2009) and rejected by Cockell (2007). Here, we might think that the discovery of a second genesis, the discovery of life *without* a common origin would entirely undermine the case for any such seeding. After all, it might suggest the widespread presence of life rather than its rarity. I am tempted to suggest that this may well be true.

A further objection to the legitimacy of the thought experiment may also be anticipated: an appeal to redundancy. The very fact that we would need to have an extra-terrestrially sourced life form in order to face the dilemma, concerning *which microbes to prioritize and send*, could indicate that life in the universe is abundant, thereby removing any rationale for the process. Ordinarily, the Fermi Paradox is taken to show that life in the universe must be either extremely rare or else abundant (Genta & Rycroft 2003). The early origin of life on Earth suggests the latter, the lack of contact with any extraterrestrial life forms suggests (more weakly) the former. Finding a second genesis, so close to home, might settle matters. This is, however, somewhat optimistic. The very locality of any discovered life might be significant. A localized one-off anomaly might account for a peculiarly favourable life-promoting configuration. Besides which, given that the Fermi Paradox really does seem to be a genuine paradox of sorts, some epistemically humility may be due. Even if we are persuaded to favour one resolution rather than another, how confident can we be in our solution before we outstrip the bounds of a *reasonable* confidence given what is at stake? Would we wager the further survival of life elsewhere in the universe upon it? Such a gamble may be a risk too far. Additionally, my concern here is not so much with the anticipation of a future practical dilemma following the discovery of nearby extraterrestrial life but with the light which this thought experiment might help to shed upon our more regular reasons for acting (and how history, and the question of origins, might figure among these reasons).

A thought experiment about microbial origins

The past or the origins of a living being can be ethically or personally significant (or both). I do not, for example, want to go home to an exact physiological duplicate of my wife, Suzanne, but to the same Suzanne who I met at the end of my teens and who sat out with me under the stars. That is to say, I want to go home to the person who is causally connected, in the right way, to events in a shared past. And sometimes the ways in which the past matters are far less agreeable. If a parent or grandparent of person x was involved in the perpetration of a dreadful event, the Holocaust for example, then person x might have duties or at least reasons for action (such as ensuring the remembrance of what took place), which other agents might not typically have. To say these things is to point out that (i) we are not,

in our everyday lives, strict individualists beyond any sense of shared bonds and obligations; but also that (ii) we care about the past in various *non-instrumental* ways, as more than a useful guide to the future. It is not obvious that any ethic which tried to set aside this kind of care (and a related sense of our own connectedness to earlier beings) would be psychologically available or a liveable ethic for beings such as ourselves. Our history, sociality and conception of who we are all seem to be closely tied together as part of a single package.

But just how history and the past might matter in the context of astrobiology is not so obvious. Partly this is because we are unsure about how far back our sense of historicity might reach, and partly it is because (unlike human predecessors whose actions impinge upon our sense of duties) microbes are not people. And yet it would be interesting to find microbial life on Mars even if it was structurally identical to microbial life here on Earth. No-one would consider it sensible to wipe it out in the way that we routinely wipe out microbes here, every day, without a second thought. And such a reluctance might concern the vague hope that structural differences might yet be found. But they might equally well be a simpler matter: such life would come from Mars, its origin would make it a special case, set apart from our normal indifference. In a more philosophical terminology, its structure might be utterly familiar, but its *relational properties* would differ. More specifically, it would have a different relation to the past.

These points are not intended to establish anything particularly remarkable. They are, if you like, a softening up exercise for the idea that ethical considerations in the context of astrobiology are not obviously an exceptional case. In other ethical contexts, historical considerations standardly apply. We do not get to ignore the past in our deliberations or the complex ways, in which it informs our understanding of what is and is not just or ethically defensible. My suggestion is that in the absence of a special case for exceptionalism in relation to ethics and astrobiology, we are entitled to assume that this same standard feature of ethics applies. But it is difficult to make much sense of such an idea at the level of the individual history of particular microbes as opposed to microbial history, and hence microbial *origins*, more generally. What follows from this, in terms of practical consequences, is precisely what the remainder of the paper is about.

Let us, for example, imagine that we have found a microbial, extraterrestrial, life form somewhere else in our Solar System, buried beneath the Martian regolith or in its ancient aquifers. Or let us imagine that we have discovered microbes on Titan or in one of the best candidate locations where astrobiologist long to look. If we want to seed another world, outside of the solar system, with life, what should we send: terrestrially-sourced microbes (however modified) or their newly-discovered, extraterrestrial counterparts? There seems to be at least one very practical reason for adopting the latter option. The extraterrestrial microbes will have shown that they have what it takes to survive under the inhospitable conditions of a planet without any complex eco-system. Of course, the track record of survival under inhospitable conditions will have to be under *comparably* inhospitable conditions: heat-loving microbes will be good candidates for seeding hot places, cold-loving microorganisms will be suitable for cold places and so on. By contrast, terrestrially-sourced microbes (even extremophiles) may seem to have had it too easy for too long. And here, it may do no good to argue that we need not choose. After all, even on a young world we would not be sending microbes to a place where the conditions were ideal for life because there already might be organisms in place. If the conditions were too good then it would dramatically raise the risk of harm to any indigenous life and risk a reduction of biodiversity on a seriously large scale. Given the comparatively challenging nature of a suitable candidate world, the survival niche might well be narrow. Sending two kinds of organisms might result in mutually-destructive competition for this niche. By going for too much we may fatally compromise the chances of success. And so, in at least some cases, we would have reasons to send only one and we might have to decide which of two kinds of organisms we send to the best target locations. This really could be a matter of either/or.

The legitimacy of the thought experiment

In spite of what has been said so far the legitimacy of deliberating about which microbes get priority and doing so by means of a thought experiment, may not strike everyone as obvious. Concerns of a general, methodological, sort may be raised. While the use of thought experiments in science has a good track record, in many ethical contexts an appeal to such experiments seems unlikely to point us towards reliable conclusions (Milligan 2007). And sometimes thought experiments about ethics only tell us what we know already (Dancy 1985). Sometimes, even more worryingly, different experiments draw out different intuitions, which happen to conflict. In part, the trouble here seems to concern the way in which thought experiments tell us how we ought to act by appeal to circumstances that we are never in. The same thing might be said about such experiments in scientific contexts too: Schrödinger never put a cat in a box with potentially lethal consequences; Einstein never stood on a railway siding for an afternoon of near-to-light-speed train spotting. Such scientific thought experiments are, in a sense, 'unexecuted' (Sorensen 1992). They depend upon counterfactuals. Yet in ethical contexts an objection to counterfactuals seems particularly salient. Ethicists have, in the past, attempted to establish some rather large claims by appeal to so rather implausible scenarios. Classic experiments about the legitimacy of abortion fall foul of this objection: would you be entitled to disconnect a talented but ailing violinist who had been umbilically attached to you by fanatical music lovers, bent on temporarily accessing your organs to ensure his survival? (Thomson 1971). Deliberation of this sort may show something, but perhaps not as much as we might like.

While hesitancy about thought experiments has not been a great concern within approaches to ethics, which stress rights or consequences, more recent trends in ethical theory ('virtue ethics' and 'particularism') are more sympathetic to such critiques (Smith 2002). But whereas this makes a good deal of

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sense in contexts such as abortion, euthanasia and embryology, special considerations may well apply in the case of ethical deliberation about astrobiology, and about space ethics more generally. Where experience can readily guide us (as it can with abortion) thought experiments may be a poor substitute for deliberations about what it is like to be pregnant and denied (or allowed) a termination. But where experience cannot guide us, something more imaginative may be required, at least until we know better. Accordingly, what makes good terrestrial ethics may not make for good astrobiological ethics, at least not for the present. Ethicists who would look suspiciously at thought experiments about key issues in terrestrial bioethics might have good reason to be open to their use in the specialized context of space.

Even so, this might not be enough to show that this particular thought experiment about planetary seeding is *worth* running. After all, it does presuppose that planetary seeding might be defensible under at least some circumstances. And this, again, is far from obvious. Perhaps not enough consideration has been given to the risks involved, risks which we do not face but which life-*in-situ* might. It could be the equivalent of sending out a plague to an unsuspecting world full of indigenous organisms. Even if we feel confident that no star maidens would be harmed by seeding (because there are unlikely to be any out there) we might still disrupt an indigenous Cambrian explosion and that definitely seems like something we should avoid.

This problem of possible harm to indigenous life cannot readily be defused by appeal to separate origins as a guarantor of safety. It is sometimes suggested that differences in biochemistry, which would result from separate origins, would prevent interactions between organisms from causing harm (Cockell & Jones 2009). This strikes me as guess work given that we have no actual interactions between terrestrial and non-terrestrial life from which we might draw even remotely reliable conclusions. An assumption of harmlessness is certainly not our guiding principle when dealing with threats of backward contamination. The default is to take the danger seriously until we have good reason to think that it is more imagined than real, although the precautions of the Apollo programme now seem rather more robust than they needed to be. Similarly, precautions against forward contamination on Mars are now more relaxed than they once were, now that we know just how biocidal the surface of the planet is. (Landers, in recent years, have been constructed in cleanrooms but are not themselves fully sterilized.)

Be that as it may, worries about harm *might* at some point be partly defused by a combination of technological advances and epistemic constraints (Milligan 2015). If we had extremely effective life-detection technologies (which we currently do not have) and if we knew that we could rely upon them in a seeding programme (which we currently do not) the project might be defensible. At the moment, it should be pointed out, none of this is the case. It may even, at the present moment, be reckless to develop the relevant technologies until socio-political circumstances allow us to be confident that they would only be used responsibly. That might, of course, involve quite a long wait. Even so, at some point, precautionary measures and responsible terrestrial practices could enhance the case for seeding.

The possible goals of seeding

In spite of what has been stated so far, the thought experiment may nonetheless fail to engage our imaginations in the right (insight generating) way if we are unclear about the goals, which could be served by planetary seeding. And here, I do not mean the institutional goals of those involved (the securing of research funding and all those objectives to which, as practicing academics, we are subject). Rather, I have in mind the goals, which might convince an authoritative audience of others without any such special agenda that the exercise was worthwhile. And here, as everywhere else in ethics, there is a great deal more to say about what might constitute an authoritative audience.

Three goals in particular seem to be at least arguable: (i) the promotion of people like us, i.e. our kind of life or an approximation to the latter; (ii) the promotion of microbial life; and/or (iii) the promotion of life as such (in some form-independent sense). In each case it might also make sense to argue that, by seeding other worlds, we are doing our best to carry out some ethical duty associated with each of these goals: *a duty to extend human life; a duty to extend the presence of life forms; a duty to extend life as such* (Milligan 2015). Here, it should be noticed, as a simplifying move, that the pursuit of goals (i) and (ii) would, if successful, also satisfy goal (iii). Whether or not the latter is anything independent of these other goals is, as a result, rather a difficult metaphysical question which we need not tackle here. What we can say is that given any goal of preserving life as such, the indifference of the latter to any kind of particularity (*this* kind of life rather than *that* kind of life) will also rule out the relevance of questions about origins.

The first of the two remaining options, (i) and (ii), is the most ambitious, but as currently stated, it is also somewhat ambiguous. There are multiple senses in which we speak of 'people like us.' There is the sense of 'members of our moral community', but we could not spread the latter because communities need regular contact, which remote seeding would not allow. Alternatively, we might refer to 'people like us' in a familiar biological sense of *Homo sapiens.* And if spreading the latter was the goal of seeding then origins again would not seem to be at all important unless we make the move of building a conception of historical lineage into the conception of species (a move for which a good deal might be said). What matters in relation to humanity in a more traditional biological sense are structure and trait rather than history and trace. Indeed, a familiar (albeit flawed) attempt to set up a core criterion for shared species membership is given in terms which are forward looking rather than backward looking, in terms of the chances for reproductive success such that *if* (all other things being equal) x and y are fertile, of the opposite sex *and* could have fertile offspring, *then* they enjoy shared species membership. Shared origins, again, do not enter into this picture. And so, if the goal is to promote something akin to *Homo sapiens* in this purely structural-trait sense (with a little bit of help from

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convergent evolution) then we should simply send the microbial life form with the greatest chance of success. And that might well be the microbes with the non-terrestrial past.

If we are to justify giving priority to *our* microbes rather than extraterrestrially-sourced microbes what we may have to bring into play is some manner of lineage intuition or rather two related lineage intuitions, one of which will do most of the work. This dominant intuition concerns the importance of human-to-human (and perhaps earlier-primate-to-human) descent. Let us call this the 'human lineage intuition'. This may be used to shape a different kind of conception of *Homo sapiens*, which treats our shared species membership *as* a shared lineage membership. But it is a lineage intuition which manifestly goes beyond our own species. Indeed, without an extended version of this intuition, familiar appeals to the *special* wrongness of primate harm and extinction would make no sense. The other intuition is parasitic upon or draws upon it: in some way lineal descent might continue to matter if we trace it much further back. Let us call this the 'dependent intuition' in order to capture a sense of how much it draws from the human lineage intuition.

Unlike the dependent intuition the human lineage intuition is *deep* at least in the sense of 'difficult to dispense with'. It is difficult to imagine how the abandonment or denial of the human lineage intuition could lead to anything other than the alienation of some brave new world scenario. It is for reasons of this sort that the kind of strict impartialism, which once held sway in ethics (in the 18th and 19th century) have now largely been abandoned in favour of approaches, which can accommodate a reasonable partiality. Those approaches most strongly associated with treating others in line with universal standards, particularly drawn from Kant, now tend to accommodate reasonable partiality in at least some domains (including but not restricted to personal relations) as something other than bias (Velleman 2009). Impartialism continues in less strict forms and with regard to some contexts where historic unfairness are at stake but few contemporary ethicists embrace the view that each of us owes *exactly* the same thing to all other humans in all contexts and irrespective of relational considerations such as shared individual or group history. I do not, for example, have exactly the same obligations to you that I would have towards a sister (if I had one) or towards co-members of one of the overlapping communities to which I belong. Partly because, by my actions, I have given rise to expectations which I am now duty bound, in some cases, to fulfil. And this really is not at all the same as some shallow (borderline racist) claim that we ought *generally* or *in some uniform way* to prioritise our own. I take it that the latter is simply false or, more precisely, there are only some historical circumstances in which it is warranted and they do not currently hold. We have, rather, special obligations to those who have helped to provide the preconditions for our own wellbeing. But that does not stand in the way of a recognition that sometimes (and perhaps often) my obligations towards others who are not part of the same community can be both different and stronger, especially so if their need is far greater than members of my own community, or if they belong to a community which has (historically) been disadvantaged by members of my own community. All of this goes, again, towards a sense that history matters in ethically deep ways, which go beyond the lives of individuals, and which do not reduce to any single pattern of prioritisation such as a notion that 'our own' must automatically take precedence. Indeed, the whole point of the thought experiment is that while shared origins might matter even in the case of microbial lifeforms, competing considerations might well outweigh any such obligations. That is the nature of the dilemma.

Intuitions about the importance of our predecessors run deep. A person might, for example, be horrified to discover that they are the descendent of some particularly dreadful figure from human history and rather pleased to discover a close lineal connection to Jesus, Confucius or Buddha. (It would be rather odd not to be pleased by the latter although different agents might prefer one of these figures over the other.) Nonetheless, we may wonder about just how deep the human lineage intuition goes. Even if we accept that it really is deep in ways which *ought* to shape ethical deliberation as one fact among many (because the latter must abide by reasonable psychological constraints governing what is and is not possible for beings like ourselves) it will still be entirely possible to affirm the human lineage intuition without actually affirming the dependent intuition, which seeks to stretch matters much further back, beyond any manner of human-like connection. It may seem that the sense of an ethically significant connection is then stretched too far, to breaking point.

Given this, if we were to conclude that the origins of microorganisms used for any prospective project of seeding are absolutely irrelevant to decision making, we might do so without in any way denying or undermining the human-lineage intuition or even its extension to close primate relations. Nonetheless, it may be difficult to resist a sense that *by analogy with the human lineage intuition* something important may have been missed. And this suggests that it may be best to regard the choice of which microbes to prioritise and send as, ultimately, an open question. No matter what considerations we offer *against* the selection of terrestrially-sourced microbes, it may always seem to a reasonable agent that something has been overlooked.

Promoting microbial life

Let us now consider option (ii), the promotion of microbial life, as the possible goal for the seeding of new worlds, although it seems like a goal of a more modest sort. Indeed, once we have mentioned the grander goal of spreading life like our own any other goal may seem to be redundant. Why, after all, would we settle for anything less than promoting the most accomplished product of evolution? Setting aside the anthropocentrism involved in this kind of response, we might do well to reflect upon the fact that, at a certain point during any seeding process, once a seeding vessel has gone beyond effective contact and perhaps even beforehand, matters will simply be out of our hands. While we might then hope for a human-type outcome of a successful seeding process, with the resulting beings lineally connected to ourselves, there is only so much that we could ever actually do in order to bring this about. But if we can do only so much then we might ask is this still worth

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doing? Would promoting microbial life or life in some extremely basic form be a sufficiently worthwhile exercise if there was no prospect that it would ever become human-like or even multicellular? Here, it should be recalled that option (ii) will automatically realize option (iii), i.e. the promotion of life as such. And this goal may seem more significant.

Additionally, there are two familiar considerations, which suggest that it might still be a worthwhile exercise. And these are considerations, which figure in Cockell (2005, 2007, 2011) as well as Cockell & Jones (2009) and again in Milligan (2015). The first is the *telos* argument: even non-sentient organisms have tendencies of development, states that would constitute flourishing. This means that they have 'a good of their own' which we have reasons to respect (Attfield 1981). They might not have a strong enough good of their own or, more simply, interest, to ground a right, and they might not be the kinds of beings who could have rights but they would still have an interest of some sort. And this might be a contributory reason in favour of seeding. It would not entail any manner of *equal value thesis* of the sort associated with Albert Schweitzer (Cicovacki 2012) and with Deep Green Ecology (Sessions 1995). We could not, with any plausibility, say that these simple lifeforms *are just as valuable as human or non-human animals* but it could support some sort of intrinsic value claim. (For a challenge to such claims, see Smith 2009, and the more qualified position of Smith 2014).

What may give rise concern here is a level of caution about arguments which appeal to teleological considerations of any sort given the implications of such arguments in pre-modern systems of physics, and in various sorts of arguments for the existence of a God. Needless to say, nothing stated here involves an endorsement of retrogressive views. Rather, it presupposes the familiar points that (i) having a telos, i.e. functioning in a particular way, is not at all the same as *being designed* to perform a particular function; and that (ii) explanation by appeal to function (which again is not the same as design) has proven to be intractably difficult to remove from the biological sciences as oppose to physics and astronomy. Philosophers of biology are split on the significance of this intractability. Some hold that teleological talk about the function (e.g. the function of the heart or of a major organ, or the apparent directionality of various non-intelligent creatures, or the movement of plant life towards the light) must somehow, in principle, be reducible to purely mechanical explanations, which remove the need for any talk about function and related telos-type notions. Others reject the idea of such a reduction and hold that teleological (direction-tending) concepts can be made safe for the biological sciences and may already be built into Darwinism in spite of the latter's rejection of the particular variants of teleological explanation found in Aristotle and Lamarck. (Although as a point of fact, various editions of Darwin's *Origins* shift about on these matters.) This argument of reduction versus non-reduction is one of the core arguments in the philosophy of biology and is unlikely to be settled here (Ariew 2007; Rosenberg & McShea 2008).

The second consideration, which suggests that seeding simply in order to spread microbial life might be worthwhile, comes in the form of the 'last man argument': the last man, with his dying action deliberately sets off some destructive process (the napalming of forests, the sterilization of the Earth and so on). Quite apart from appeals to possible sentient life destroyed in the process, it seems that this last man does something wrong and that some claim about wanton harm is going to be bound up with our best account of exactly what it is that he does wrong (Sylvan 1973). Indeed, by contrast with the *telos* argument, wrongness here may not actually require a life-form at all but merely the wanton damaging of some object with structured 'integrity' (Rolston 1986). This would fit in with at least some widespread intuitions that even with regard to planets where there is not life, we still have at least some ethical obligations which are not simply about terrestrial interests (Rummel *et al.* 2012). Inconveniently, we might have a concern here about 'proving too much' by showing that lifeless planets deserve certain kinds of respect, which would conflict with any project of planetary seeding. However, the prospect of any such conflict would depend upon the impact of seeding upon planetary integrity, and that would be a contingent matter. (So, in some cases there might be a conflict and in others there might not.)

Setting aside such matters of fine judgement in particular cases, we may at least say that if it is wrong to harm wantonly irrespective of *what* is harmed, then it will be wrong to harm microbes for no reason at all. And if this is the case then it might, conceivably, also be right to promote microbial survival under some circumstances. And a set of circumstances under which microbes are the only form of life whose survival we can promote would seem like a good candidate. Although here, the rightness of *promoting* involves a far stronger claim than the wrongness of wantonly *harming*. Leaving alone is one thing, actively aiding is another. Even so, in its favour, this approach might dovetail nicely with the recent argument from McKay (2013) that astrobiological ethics should be shaped by a concern to *expand* the richness and diversity of life. Again, an idea of *promoting* is in play and the kind of life in question can be any sort of life whatsoever.

However, neither the *telos* argument nor the last-man argument on its own does enough work to support anything like a requirement or actual *duty* to extend this kind of life. There is, however, a *reinforcer* for both that might help to take one or both arguments the required extra distance. This *reinforcer* may be formulated as a precautionary principle. (Although there will be other ways of putting matters by appeal to 'reasons' rather than 'principles'.) What reinforces the case for taking microbial into account for the purposes of deliberation about seeding is the fact that, when it comes to the non-human, we have been mistaken so many times in the past about what matters, how it matters and how much it matters. Given this, and given the potential stakes, the end of all such life, we should perhaps err on the side of caution and promote survival rather than merely restricting harm.

Given this, we have no reason to set aside the promotion of microbial life by appeal to its triviality. But should we be in the business of promoting the survival of any particular lines of microbial descent and our own very remote relatives in particular? It is, as conceded at the outset, conceivable. But we

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would perhaps then be seeing our microbial relations in terms of *what they could become* or in terms of *what they might have led to* under other circumstances. Some of these, and similar considerations may look suspiciously like the projection of significance rather than its discernment. Others may seem less so.

Conclusion

So where does this leave us? In relation to goals (i) and (ii), the goals of spreading our kind of life or microbial life, it does seem at least conceivable that we might justifiably appeal to shared origins as a reason for favouring seeding with terrestrial microbes rather than non-terrestrial microbes. *However, in no case do the reasons for this appear to be strong enough to act as an automatic silencer for rival considerations* such as the likelihood of success, the enhancement of diversity or even considerations of justice. Should we disrupt a nearby world and corrupt the sustaining environment for a microbial life form, this might function as a reason to try and give this lifeform a chance of survival elsewhere. If the Earth was too dangerous an option, a process of seeding would then be tempting. But what is conspicuous about all of these potential, and to some extent competing, reasons for deciding one way or the other (likelihood of success, origins, spreading diversity, making amends for injustice) is that they compete without silencing or overwhelming. And this might remove any misleading suspicion that an acceptance of value considerations in contexts of this sort must always be too demanding. Instead, as in more familiar ethical contexts, the give and take of conflicting reasons and of practical wisdom seems to hold sway.

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