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Exhaustible Resources and Future Generations

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Exhaustible Resources and Future Generations

Abstract: How shall we be just towards future generations with regards to resources, like oil and coal, which are finite and cannot be replenished? One standard answer among economists and philosophers is that we should offset any use of such resources by saving and passing on an equal amount of some alternative good, like money. I argue that this offsetting approach is mistaken, because it rests on two false assumptions: that each generation is owed every bit of the initial stock of resources, and that every generation is owed such equally. I then offer a new framework for inter-generational distribution of such resources, based on sharing it between all and only those generations that value a given resource.
Keywords: Exhaustible resources; finite resources; intergenerational justice; egalitarianism; distributive justice.

1. Depletion of Exhaustible Resources and Justice for Future Generations

Exhaustible natural resources present a special difficulty for justice between the generations. Unlike other components of the natural world, the finite and non-renewable nature of such resources means that any exploitation by one generation permanently removes some of the total stock from all future generations. And if the initial endowment is small enough and the exploitation rapid enough, eventually all of an exhaustible resource will be depleted, and all generations past the exhaustion point would be deprived of the resource entirely. This is a problem because it would seem that by depleting and eventually exhausting finite stocks of natural resources, earlier generations do later ones an injustice.[1]

This is the situation we face with regard to things like carbon-based energy resources like oil and coal. Although the size of the initial stock varies quite a bit between them, in each case our current rate of exploitation will exhaust the total stock within a few centuries at most, and in all likelihood quite a bit sooner than that, given that consumption rates have been steadily increasing since we began exploiting these resources, and that population and economic trends

[1] I am going to assume here that we can act unjustly towards future generations, although there are notorious difficulties with the theoretical explanation of this intuition (cf. Parfit 1981, 1983). My thinking here is that my intuitions that we can (unjustly) harm future generations are strong enough that the problems with them are problems to be solved, not objections that defeat the assumption.

indicate a vast increase in demand on the horizon as poorer countries become richer.[2] So the problem is– if we are short-changing future generations by our use of exhaustible resources, what must we do to rectify the situation?

One way people have answered this question is by proposing that generations who deplete exhaustible resources need to offset this depletion by paying compensation to future generations in some coin or other. The compensation is an offset because the value of the compensation is pegged to the amount of depletion, so we can call this sort of approach an 'offsetting' solution to the problem.

Offsetting solutions are generally advanced by egalitarians, those who think that justice between the generations, at least as regards the bounty of the earth, requires that every generation get an equal share. Although offsetting solutions are by no means the only sorts of answers in the literature[3] they are quite popular, and the egalitarian intuitions and principles that ground them are similarly popular, especially with moral and political philosophers, but in other disciplines as well. Further, egalitarian justice seems especially apropos for the distribution of 'manna from heaven' goods. These are goods, like the natural resources of the earth, which exist due in no part to the efforts of humanity at all.

But despite all this, I think that offsetting solutions to the problem of exhaustible resources are radically flawed. My critique isn't with egalitarianism as regards the distribution of

[2] For the purposes of this essay am setting aside issues of global climate change as a result of loading the atmosphere with carbon from the burning of hydrocarbon fuels. These issues will (we can only hope) constrain global consumption of hydrocarbon fuel, although there is always the possibility that a technological solution to the carbon emission problem will be found. But the issues of distributive justice between the generations I address here concern all such exhaustible resources, not just those that produce greenhouse gasses when burnt (natural gas, for example) and so even if this reasoning doesn't turn out to be relevant for oil and coal, the problems are still worth considering.

[3] There are a number of other schools of thought concerning the question of intergenerational justice *tout court* in the philosophical literature: e.g. varieties of Sufficientarianism. But the egalitarian/offsetting proponents have written the most on the particular issue of exhaustible resources. For a good overview of the more general issues, see the entry on "Intergenerational Justice" in the Stanford Encyclopedia of Philosophy (http://plato.stanford.edu/entries/justice-intergenerational/)

natural resources *per se*, nor with the idea of offsetting compensation for the depletion of resources. Rather my problem is with the supposed linkage between the two. Specifically, I don't think that an egalitarian view of intergenerational justice necessarily requires the sort of offsetting that its proponents take it to require.

Offsetting proponents mistake what egalitarian justice demands with regards to these resources in two crucial ways: they think that an egalitarian approach mandates that each generation has a just claim to the entire initial stock of exhaustible resources; and they think that every generation that has or will ever live on the earth has the same claim to that initial stock as every other. It is these two claims that mandate the offsetting solution.

But I think these claims are mistaken. I argue for this in the following ways: In the case of the first claim I employ a distinction between two ways in which things can be shared, by parts and by turns; in the second I argue that justice can only make demands on the distribution of valuable things, and that not all generations will value all exhaustible resources. I then propose an alternative framework for thinking about what justice demands with regards to exhaustible resources, and I explore some of the implications of this new position for the consumption policies of contemporary generations.

2. Egalitarianism and the Offsetting Solution

There are two varieties of the offsetting solution in the literature, one sort offered by economists, the other by philosophers. They differ principally in what they assume needs to be equally distributed between the generations. The economic version of the solution proposes to distribute utility, via some palpable proxy like capital or consumption-rate, while the typical philosophical version distributes not utility but rather 'productive opportunities' or 'options'.

In economics there is a sizable body of work on the issue of the just intergenerational distribution of natural resources. Much of it is from the 1970s and 80s, spurred by John Rawls' consideration of the issue of intergenerational justice in his widely influential *Theory of Justice*, (1971). Populated with people like Harold Hotelling (1931), M.J. Beckman (1974), Robert Solow (1974, 1978, 1986), Partha Dasgupta (1974, 1983), Joseph Stiglitz(1974), C J Koompans (1973), John Hartwick (1977, 1978) this corpus is largely formal, using growth-theory models to work out the implications of different normative assumptions about the proper distribution of resources, or the utility from those resources.

What interests me here are those framing normative assumptions about distribution, in particular an egalitarian assumption present in much of this work: the idea that justice [or 'equity', to use a term from the texts] between the generations requires that every generation enjoys the same amount of utility from the earth's resources as every other generation.[4] In cases like those of exhaustible resources, where that equal utility can't be derived exclusively from the resources themselves, then compensation in the form of some other source of utility, like capital, is required to offset the loss. John Hartwick's proposal is a paradigm version of such a view. In his 1977 paper *Intergenerational Equity and the Investing of Rents from Exhaustible Resources* Hartwick notes that, unlike the cases of intergenerational savings that spurred Rawls' commentary (cf. Rawls, 1973), the issue of exhaustible resources was concerned "…with *forestalling decumulation* of society's productive capital in order to achieve some notion of intergenerational justice." (Hartwick, 1977, p. 972, fn. 2, emphasis in the original)

[4] This is, by necessity, a very brief overview of a large and complex literature, and I don't want to leave the impression that all the work in the formal economics of exhaustible resources was egalitarian in its assumptions, nor even that all the egalitarian work used the same assumptions as the offsetting solutions did; many other sorts of normative targets (maximizations of various sorts, in general) are considered. But the sort of egalitarianism I describe here is well represented. For an excellent survey of the early work in this area, see the *Review of Economic Studies* special volume on the topic (Vol. 41, 1974).

On this picture, the resources of the earth are conceived of as an endowment of economic capital, and justice demands that every generation receive the same amount of this capital. Given this view of intergenerational equity, the drawing down of exhaustible resources by present generations must be offset by investment of extra capital, so that future generations would not receive less initial capital than those before them.

Philosophers come to the issue a little later, in the 1980s and 90s. In the philosophical literature Brian Barry (1983, 1999), Robin Attfield (1998), Michael Young (1993), Talbot Page (1983), E Brown Weiss (1989) have also entertained the idea that future generations ought to inherit no less than what prior generations had. Brian Barry's view is perhaps the most influential one, so I will take it as the paradigm.

Barry is motivated by a similar (egalitarian) view of the demands of justice as the economists, that equity between generations requires that the benefits of the earth's resources be made equal across all generations. But unlike the economists, Barry thinks that what is important about these resources, and thus what should be equalized across generations, are the productive opportunities or options that those resources represent, rather than the utility to be derived from their consumption (Barry, 1983:18-20).

What is especially interesting, for my purposes, about Barry's discussions of these issues is that he explores in some detail the reasons behind the egalitarian approach, and in particular, he offers us a at least part of the reasoning that takes him from egalitarian justice to the need for offsetting:

> "The basic argument for an equal claim on natural resources is that none of the usual justifications for an unequal claim – special relationships arising in virtue of past service, promises, etc., applies here. From an atemporal perspective, no one generation has a better or worse claim than any other to enjoy the earth's resources. In the absence of any powerful argument to the contrary, there would seem to be a strong

> presumption in favour of arranging things so that, as far as possible, each generation faces the same range of opportunities with respect to natural resources. I must confess that I can see no further positive argument to be made at this point. All I can do is counter what may be arguments on the other side. Is there any way in which the present generation can claim that they are entitled to a larger share of the goods supplied by nature than its successors? If not, then equal shares is the only solution compatible with justice." (Barry, 1983: 21)

So the principle that "each generation [ought to] face the same range of opportunities with respect to natural resources" follows from the claim that each generation has an equal claim to those resources. The inference proceeds through Barry's claim that what is important for questions of justice about the resources of the earth is the 'productive opportunities' they represent to people. So since individual generations have an equal claim to the resources of the earth itself, they thus have an equal claim to the productive opportunities those resources represent.

So far though, the position doesn't yet demand offsetting. What the argument establishes (if it is sound) is that every generation has an equal claim to the productive opportunities represented by the natural resources of the earth, including the exhaustible ones. In Barry's own words, justice demands that they all receive an 'equal share' of this bounty. But that a pool of people have a claim to equal shares in something doesn't yet mean that any use of the thing by anybody in the pool necessitates offsetting compensation to the other pool members.

Rather, offsetting follows from the way that Barry conceives of the notion of 'equal shares' in this context. For Barry, the equal shares that generations have in the resources of the earth are in fact equal claims to the entire stock. In other words, Barry takes it that each generation has a claim to the entire initial stock of resources in the earth. And this interpretation of 'equal shares' makes an offsetting solution inevitable, since if every generation is owed every

drop of oil (for example) that the first generation had available to it, then any use by any generation would have to be offset so as to respect the next generation's claim to the entire initial stock. And so ". . . justice requires us to compensate future generations for depleted resources, so they have as much productive potential as they would have inherited had the resource not been depleted." (Barry 1983: 20)[5]

And Barry is not alone in this maximalist interpretation of the idea of 'equal shares' of the earth between generations. Indeed, something very much like it is implied by the very structure of the typical economic offsetting solution. Consider Hartwick's proposal for a mechanism to guarantee that the initial stock of a resource, imagined as 'productive capital', is never lessened. This could only be mandated by justice if every generation had a claim to the entirety of the initial stake. This, then, is the first mistake offsetting proponents make with regards to what egalitarian justice demands for exhaustible resources: that every generation is owed every bit of every such resource.

This maximalist interpretation of 'equal shares', where the shares are equal because everyone is owed everything, just doesn't sound very plausible as a solution to the sort of distribution problem we face here, one of distributing the finite stock of exhaustible resources between the generations. To see this, consider an analogous case: Suppose we were to divide a pie between children, and suppose further that none of the children had any prior relationship to the pie that would give them a claim to a particular amount of it. None of them helped to make it,

[5] That Barry believes every generation to have a just claim to the entire initial stock of all resources isn't just something that must be inferred from the compensation scheme, Barry makes it plain in other ways. For example, he says that present generations might acquit themselves of their duties to future generations in this area by "pass[ing] on the resources base that we- the present generation – inherit." (Barry, 1983: 17) Moreover, he goes on to say that depletion of exhaustible resources is not *justified* by the compensation his offsetting view demands, since compensation doesn't justify the violation of a just claim. Rather, such exploitation is justified by exigency, in the manner of a lost traveler breaking into a cottage for warmth in a storm (Ibid). Both of these assertions make sense only if he holds that every generation has a just claim to the entire initial stock.

none were promised any of it, etc. In other words, no child has a better or worse claim to the pie than any other. What does each child have a claim to, in such a case?

I think the obvious answer is that each child has a claim to an equal share of the pie. And what that means is that each child has a claim to an equal *part* of the pie. On the egalitarian view each child would have a claim to 1/*n* of he pie, where *n* is the number of children in the distribution pool. But on Barry's construal of 'equal shares', it would seem that each child would have a claim to the *entire* pie. But that just seems implausible. Why would we infer from fact that the children had equal claims to the pie that they each had claims to the whole pie? When looked at in this light, as a distribution problem of sharing a finite, exhaustible good between members of a distribution pool, the assumption that every generation is owed all of the initial stock of an exhaustible resource doesn't just seem wrong, it seems ridiculous. So why do offsetters like Barry adopt it?

Barry doesn't give (and I haven't been able to find elsewhere) an explicit argument for the maximalist interpretation, but I think I have a diagnosis of why such an odd sounding claim could be so widely accepted. I think that the problem here is one that can best be explained by appeal to an important distinction between two types of distribution: sharing by parts and sharing by turns.

3. Sharing by Parts and Sharing by Turns

There are (at least) two ways in which we might be said to share something between people: by parts and by turns. A pie is shared between children by parts, but a car is shared between siblings by turns. Any principle of just distribution - for example an egalitarian on like 'absent good reasons to the contrary, recipients in the distribution pool should get equal shares' - means different things in the two types of cases. In a case of sharing -by-parts, like the pie, equal

shares means something like each child is owed 1/*n* of the pie, where *n* is the number of children in the distribution pool. Whereas in a sharing-by-turns case, like the car, equal shares means something like every sibling is owed an equal turn (or set of turns) with the (whole) car.

In simple cases what determines whether a distribution is a case of sharing-by-parts or sharing-by-turns is the nature of the good being distributed. Some types of goods, especially goods like pie that are destroyed in their consumption, are naturally shared by parts. Other sorts of goods, like cars, that are not destroyed in their consumption but can be maintained across many uses, are naturally shared by turns.[6]

More complex cases feature goods that can be shared either by turns or by parts. There are at least two sorts of these cases: cases where a simple good, i.e. one that is uniformly the sort of thing that is generally shared one way or the other, like pie, has some consumptive value when used the other way; and cases where a complex good, i.e. one that has components of both sorts of goods, is to be shared.

As an example of the first sort imagine a pie that wins the blue ribbon at the county fair, where the two people who made and entered the pie in the contest determine to 'share' it. They might decide to cut the pie in two, and each take home and eat their share of the pie, or they might decide to have the pie encased in glass and mounted on a display, which they would then take turns having on their mantles. In both cases we would say that they are sharing the pie. The ambiguity is a result of the pie having some value (that pies generally lack) when consumed in a non-destructive (to the pie) manner. But we can easily disambiguate by reference to the distinction: in the first case they share the pie by parts, in the second by turns.

[6] I don't mean to imply here that the only thing that determines how a good is to be shared is whether it is destroyed in its consumption. There are, I think, more varied and more subtle conditions called for here than I have space to investigate. Suffice it to say that destructive consumption is typically the sort of property that does determine such a question.

As an example of the distribution of a complex good, consider again the siblings sharing a car. A car is a complex good in this sense, since one of its components is fuel, and fuel is generally a share-by-parts resource (because it's destroyed in the consumption), while the rest of the car is non-exhaustible, and thus a share-by-turns good. When the siblings set out the terms of their sharing of the car, they can treat the gas in two different ways, either as a separate good to be shared by parts, or as a part of the larger durable good, to be shared by turns. If they opt for the first route, then they would treat the total initial amount of gas in the car as a fixed and finite good, and each sibling would have a claim to 1/*n* of that good. If they opt for the second route, they would treat the car + gas as the good to be distributed by turns, and thus decisions of justice concerning the gas would turn on what amount of gas the car must have at the beginning of each turn for it to be a fair turn.

This last consideration brings into focus a crucial element of egalitarian sharing-by-turns. It is not enough for turns to be equal in number among members of the distribution pool, turns must also be equal in a *qualitative* sense. If the siblings are to share the car equally, it must be the case not only that every sibling gets the same number of turns, but that each turn represents the same opportunity to use the car as every other turn. And thus egalitarian sharing-by-turns mandates what we might call duties of maintenance, that is, duties on those who take turns sharing the good to maintain it, so that those who take their turns afterwards can enjoy turns of the same quality.

These duties of maintenance often include duties to insure a sufficient amount of vital yet exhaustible components of complex goods, like the gas in a car, or the battery life in a mobile phone, is passed on to the next user. So if the egalitarian siblings in our example decide to treat the gas in the car as part of the car itself, then they would be subject to a duty of maintenance

regarding the gas, i.e. to return the car to the common stock with sufficient gas for the next turn. The practical result of such an approach would be an arrangement where each sibling offsets the amount of gas used in a turn by replenishing the tank to the original level at the end of their turn. This would be in contrast to a sharing-by-parts arrangement, where the principal issue would be what portion of the total initial stock of gas each sibling is allowed to use, and the resulting duty of the siblings would be one of abstention, to refrain from using more than one's allotted portion.

The way in which the above distinction maps to the issue of intergenerational distribution of exhaustible resources should, I hope, be evident: If we treat the earth as a complex good to be distributed between the generations, then exhaustible natural resources comprise an exhaustible component of the (otherwise durable) earth, and the question is which method of sharing we shall use to distribute them. Proponents of offsetting solutions propose to use the sharing-by-turns approach, and thus consider the initial allotment of natural resources as a necessary condition of a fair turn on the earth, since they represent a turn with sufficient opportunities for the enjoyment of the earth. As such, each generation has a claim to the entire allotment, and any depletion by any generation must be offset.

This is why it seems reasonable to offsetting proponents to claim that every generation is owed the entire stock of resources, even though an exhaustible resource would generally be a share-by-parts sort of good: because they are treating the resources like they would treat gas for a car they share – as something every member of the distribution pool has a right to as a condition of a fair turn. So in the same way that it's reasonable to demand that the car be passed to you with a full tank of gas, it's reasonable to demand that every generation get their full and fair allotment of exhaustible resources. This is (in my estimation) why it seems reasonable to offsetting proponents to construe an 'equal share' of these resources as all of the initial stock.

But I think this is a mistake. I think that the correct way to share the exhaustible resources of the earth is by parts, rather than by turns. With the distinction in place let me offer an argument premised on general considerations of when the distribution of an exhaustible component of a complex good is one for which we should adopt a shared-by-parts approach, and when sharing by turns is more appropriate.

There are two factors relevant to the determination of which distribution scheme to select in these complex cases: the ease of replenishment of the exhaustible good, and the importance of the exhaustible good to the quality of the turn. These in turn represent two axes on which to measure exhaustible components of complex goods: an axis of replenishment- from easily replaceable to completely irreplaceable, and one of importance to the quality of a turn- from absolutely essential to completely superfluous.

The more easily replaceable a good is, *ceteris paribus*, the more reasonable it is to share it by turns. And the converse is also true, the more difficult it is to replace a good the less reasonable it is to share it by turns, and the more reasonable it is to share it by parts. So, in the case of the car, as gas is readily available on almost every corner it is reasonable to adopt a share-by-turns system, where each member offsets her use by refilling the tank to its previous level. But things are different in a case where the exhaustible good can't be replenished. For example, imagine a group of people camping, and sharing the use of a mobile phone with a full battery charge at the start of the trip. If they are to share the phone equally, then they must treat the battery life as something to be shared by parts, that is, a separate finite and exhaustible resource of which (on an egalitarian distribution) each member of the distribution pool is owed a 1/*n* share. This is because in the absence of the ability to replenish the battery, the maintenance duty

to offset battery use that would be demanded by a sharing-by-turns distribution is impossible, and the salient duty on users is one of abstaining from going over their allotment.

On the other axis, the more vital an exhaustible component is to the quality of a turn, *ceteris paribus*, the more reasonable it is to distribute it by turns. And again the converse is also true, the less vital a good is the more reasonable it is to distribute it by parts. A good whose presence is a pre-condition of a turn's quality, like fuel is in the car-sharing case, is one where it is perfectly reasonable to share the good by turns, and thus treat it as a necessary component of any proper turn. But in cases where the good is a merely an extraneous addition to the quality of a turn we have more reason to treat it separately, and divide it by parts. As evidence of this, suppose that a group of people will be sharing an apartment by turns, and they set out to decide on the terms of the arrangement in advance. If they discover that there will be a bottle of whiskey left behind by the previous tenants, how would they go about distributing this boon among the members of the group? If they are egalitarians, the obvious answer is to give every group member $1/n$ of the whiskey, where n is the number of members. This certainly seems more intuitively correct than treating the whiskey as a necessary component of the apartment, one that had to be present for the apartment to be considered fully furnished, as it were, and thus requiring that any consumption of the whiskey by a tenant had to be offset (by replenishment or compensation) by that tenant, so that the next tenant might enjoy the full measure of whiskey.

Now it seems to me that the exhaustible resources of the earth I have been discussing, like oil and coal, are on the share-by-parts end of both axes. They are both irreplaceable, and not sufficiently vital to the quality of a turn on the earth to be proper objects of a duty of maintenance. I don't think I need to offer any evidence for the first of those two claims, I take it as obvious that we cannot replenish the oil in the ground. But even so, it might be argued that

such resources are important enough to the quality of a generation's time on the earth that they are proper subjects of a duty of maintenance despite being irreplaceable, a duty that must then be discharged through alternative compensation.

But it strikes me that this latter claim is wildly implausible, given that, in the case of oil, surely more than 99% of the generations that have ever lived on the earth did so without using (petroleum) oil at all. And in all likelihood the total number of oil-consuming generations will be an even smaller fraction of the total number of generations, past present and future, to live on the earth. Anything that will only be enjoyed by a minute fraction of the generations of the earth can't be said to be especially critical to the quality of a turn on the earth, unless the human lot is significantly more bleak than is commonly thought.[7]

4. Distribution Pools and Window Resources

So I think it is more reasonable to share the exhaustible resources of the earth by parts, rather than by turns. But what does this actually entail? Well, if we continue with an egalitarian approach, it means that the generations of the earth are each entitled to $1/n$ of the stock of any given resource, where n is the number of generations in the pool.

But this change might not yet avoid the offsetting solution. If we plan to divide the stock by parts, the large (we hope) number of future generations, and the relatively small initial stock will mean that the share each generation would be due would be too small to be of any use. Thus any useful consumption would still infringe on the claims of future generations, and as a result we would still have to resort to an offsetting/compensation scheme. And as n approaches infinity and the ratio approaches zero, the difference between the actual amount of compensation

[7] N.B.: To say that the oil isn't necessary for the quality of a turn is not to say it isn't valuable, at least to some generations. Exhaustible resources of this sort can be quite valuable, and still not be subject to a duty of maintenance. For example, if our flat-mates discovered a 100-year-old bottle of port worth thousands, rather than an unremarkable bottle of whiskey, they would still share it by parts (although that might take the form of selling it and distributing the proceeds rather than drinking it).

exploiting generations need to put up in the two cases also goes to zero. So it might seem that the distinction between sharing by turns and sharing by parts amounts to no practical difference in cases where the size of the pool is very large.[8]

But note that this result is only because of another egalitarian assumption, namely that every generation has exactly the same sort of claim to the resources as every other. This is what I referred to earlier as the second mistake that offsetting proponents make about egalitarian justice and exhaustible resources. And as we see, it also seems to result in an offsetting solution. So let us take a closer look at the reasoning behind this claim.

Again, Barry can supply us with the argument here, and it's contained in the passage quoted above – every generation has an equal claim to the resources because none of them have any special claim to them. But I think that the conclusion here is too strong. While it is certainly true that in these 'manna from heaven' type cases no special historical relationships exist between generations and stocks of natural resources that would be reasons for an unequal distribution, that alone isn't enough to conclude that every generation actually has a claim to those resources.

Recall that the structure of the problem was one of sharing a finite good (exhaustible resources) between the members of a distribution pool (the generations of the earth). Barry's claim that no generation has a special relationship to the natural resources of the earth that would grant them more of a claim to the resources than any other generation is supposed to be an argument for the claim that every generation should be included in the distribution pool. But this is too quick - the fact that no generation has a special claim to the resources is not enough to

[8] Note that even if all of the above is granted, it's still no reason to adopt the maximalist assumption that each generation is owed the entire stock. If you promise to share a pie between the children at a party and 1000 children show up, making the equitable division impossible and requiring you to issue compensation in the form of 'rain cheques', you wouldn't hand out cheques for an entire pie.

infer that every generation has an equal claim to them. This is because in ‘manna from heaven’ cases the conditions on inclusion in the distribution pool aren’t limited to those concerning antecedent relationships between a candidate and the good to be distributed.

One such condition on inclusion in a distribution pool in ‘manna’ cases is the following: In order for a candidate to be included in the distribution pool for a given manna good, that good must have some value for the candidate. If a good is valueless to a candidate, then they have no claim to a share of it on grounds of justice, and thus shouldn’t be in the distribution pool. The argument for this condition is the following: the norms of justice only apply to resources that have value to the potential recipients. And since not all generations will value oil (for example), not all generations will have a claim to a share of it – at least not a claim grounded in justice.

As evidence for the proposition that justice makes no demands on the distribution of valueless things, consider another toy case. Imagine I am given a set of small, unremarkable pebbles, and there are ten people in the room, each of whom has an equal claim to the pebbles in the same manner as before (i.e. none has a special relationship to the pebbles that would argue for an unequal distribution). But let us further stipulate that none of the people present has any use for, nor any desire for, any of the pebbles. Now, what do the norms of justice have to say about the proper distribution of the pebbles? If I give them out unequally, or not at all, have I wronged or harmed anyone? I think the answer to these questions is ‘no’, and that because I don’t think that justice has anything at all to say about the distribution of valueless things.

And this stands to reason, as distributive justice is about arbitrating between competing claims, on the understanding that such arbitration is necessary because people have something at stake in their claims, and if those claims aren’t vindicated, they stand to lose their stakes. If the

things claimed are valueless, then people don’t have anything at stake, and we don’t feel the need to arbitrate to avoid unfair losses.

Given this restriction on inclusion in distribution pools, generations who don't value a given manna good have no justice-based claim to it, and thus ought not be included in the distribution pool when we set out to distribute it between the generations. This condition might not sound relevant when we consider something like oil, which not only has great value to us in the present but also seems like the sort of thing which will always have value, since it is a source of energy – which is of enduring value. But there are at least two reasons why a resource like oil might be valueless to a generation.

The first is because the generation lacks the technology necessary to exploit it. For example, oil was valueless to our stone-age ancestors: They didn’t even know it was there, and even if they had known, they wouldn’t have been able to get to it, and even if they had been able to reach it they wouldn’t have known how to refine it, and even if they could have done all that, they didn’t need refined oil for any purpose, or at least for any purpose that couldn’t be served much better by other resources, such as wood. So in a straightforward way the oil was valueless to them.

But another way that a resource can be valueless for the purposes of distributive justice is for it to be displaced by a superior competitor. A competitor for a resource is just another resource (or set of resources) that has all the same uses as the first resource. So, for example, consider again our cave people. Imagine that they have mastered the art of making fires and stone tools using flint rock. And imagine further that these functions are absolutely vital to their survival. Given this picture, we can assume that flint rock is a very valuable resource to them, and as such the distribution of flint rock among them is subject to the demands of distributive

justice. But given all this, what does justice have to say about their distributing some of that flint rock to us? Do we have any claim to the flint rock? Put it another way, if they used up all of the flint rock before we came on the scene, would they have wronged us?

The answer to all of these questions is, of course, 'no'. They don't owe us any flint rock, and they wouldn't have harmed us if they had used it all. But this can't be because flint rock isn't useful to start fires or make stone tools in our time. Flint rock retains all of the properties that made it useful to the cave people. Rather, what happened was that we discovered vastly superior means of performing the sorts of tasks the cave people used flint rock to perform, and as such it was displaced as a valuable resource to us, and we can no longer make claims on it from the grounds of distributive justice.[9]

What the above points to is patterns of changing value, and thus changing demands of justice, for resources relative to the technological status (among other things) of the potential recipient generation. As technology changes over time, different sorts of resources become exploitable, and thus valuable, and by the same token, different sorts of competitors for existing resources also become available.

One obvious sort of pattern is one wherein a resource is at first valueless, because the generations at that stage can't exploit it, then it becomes valuable as the technology to exploit it comes on line, and then finally it loses its value as technology improves to allow the exploitation of superior competitor resources. The flint rock in the earlier example is something like this. We

[9]Both the idea that exhaustible resources are inter-substitutable (see the literature on substitutability as a factor in the models on exhaustible resource distribution (e.g. Beckman 1973, Hartwick 1978, etc.)), and that future generations might not desire some of the resources we currently do (cf. Page, 1983: 54), have appeared in the literature, although neither of those bodies of work derives the sort of normative implications from these facts that I do here.

can imagine some time prior to figuring out how to chip flint rock into cutting tools etc. that the rock was valueless to the people living there. Then later, after the techniques were invented, the rocks were quite valuable to them. And finally, much later, the rocks return to being valueless, as new and better techniques for starting fires and cutting material become available.

We can call such resources ‘window’ resources, because they have a window of value, which is the interval between the advent of the exploitation technology and the advent of superior competitors. And it seems to me that the window pattern applies quite well to exhaustible resources like oil. Prior to the technology that made the refining and combustion of oil possible (as well as the technologies that made such a powerful, compact energy source desirable) oil is valueless to the generations that occupy the earth. Once the exploitation of oil becomes possible, then oil becomes valuable, as it is now. But when other technologies come on line that will out-compete oil for what it does (as an energy source, I’m ignoring, for present purposes, other uses of oil) then oil will lose its value. In other words, oil is a window resource.

So what does the earlier value-based restriction on the distribution pool mean for distributive justice for window resources like oil? If we take it that the demands of justice only apply when the potential recipient values the resource, then it would seem that shares of resources aren’t owed to generations for whom they have no value. So in cases of window resources this means that shares would only be owed to those inside the window of value. Those to the left of the window on time line, the cave–dwellers and others, aren’t owed anything because the resource is valueless to them as they lack the ability to exploit it. Those to the right of the window on the time line, those in the fusion future, aren’t owed anything because they don’t need it, they have their fusion (or whatever), and thus the oil is valueless to them.

And this limitation on membership in the distribution pool in turn means that the difference between sharing by parts and sharing by turns becomes salient again. If the number of generations in the pool is limited to those inside the value window of a resource, then a sharing-by-parts approach won't require any offsetting compensation, so long as the number of generations in the pool doesn't force the ratio too low.

In summary then, my view is that, contrary to offsetting proponents, exhaustible resources ought to be shared by parts; and only those generations who value a resource have a claim to being in its distribution pool. In other words, I think that we should be distributing the initial resource stock between all and only those generations who value that resource.

These assumptions don't beg any questions against different approaches to distributive justice. That we ought to share a good by parts rather than by turns, or that some people ought not have a share because they don't want or need one, are issues that are completely independent of the question of how we ought to share the good out. I have been entertaining an egalitarian answer to the latter question here, but a sufficientarian could just as easily adopt both of my claims.

Regardless of the distributive principle we use inside the window, what the above framework implies is that we should guide our decisions about resource use and distribution with reference to our best guesses as to the following sorts of empirical facts: how much of the resource remains? How long will it last at the current rate of consumption? And when will the competitor resource technology likely appear?

5. Bridges, Gaps and Contemporary Generations

What would the effects be on contemporary resource policy of adopting the share-by-parts approach? At the conceptual level, the change would be quite far-reaching. Instead of

conceiving of the initial resource stock as a capital endowment to be preserved across time, we would think of it as a limited good to be distributed among a (relatively) small pool of generations. What seems fair in the division of a good between the members of a small (and temporally contiguous) group of generations might be different than that between all generations.

Also, the share-by-parts approach produces different sorts of duties in those capable of affecting the distribution. As I mentioned earlier, sharing by parts comes with a duty of abstention, a duty to abstain from the shares of others, or not use more than your share. So instead of focusing on the value of the resource we currently use, and the amount of it that should be saved and passed on, the share-by-parts approach would have us talk about our share, and the amount we are allowed to use, given the shares of other, future generations. This seems much more conducive to policies of conservation and preservation than the current paradigm.

The exact shape of the duty to abstain from the shares of others is difficult to forecast for something as complex as national resource policy. It might be that calculations about individual shares inside the window are too subjective and noisy to be of much use in making policy. Even so, the share-by-parts approach can ground duties that can have a direct bearing on contemporary policy. For example, a sharing-by-parts approach would ground a duty on the part of contemporary generations to avoid harming those generations in the near-term future (our likely cohorts in the window) by exhausting the resource prematurely.

Given that the leading edge of the window of value is determined not by the availability of the resource at issue but rather by the state of the technology of a given generation, there exists the possibility of a gap between the exhaustion of a window resource and the closing of the value window. If a window resource is also an exhaustible resource, as oil is, then it's possible for the early generations inside the window to over-consume the resource, such that it's

exhausted before a replacement resource is available. In that scenario, the generations between the exhaustion date and the arrival of the new technology have had a claim violated; and every generation inside the window has a duty of justice to ensure that they do not cause some future generations to fall into the gap by over-consuming the resource.

And this is perfectly consonant with our intuitions about whether and why it would be bad to use up all of the oil before another energy source is found: because the hardships faced by the immediately future generations would be our fault. But note that intuitively this sense of guilt doesn't extend outward towards those in the distant future. If we exhausted all the oil in this century, the hardships of the next would be on our consciences, but not the worry about having cheated the denizens of the Star Trek universe of their share of oil.

This duty contemporary generations have towards their window-cohort is grounded in large part in the measure of control those generations have over both the time-to-depletion and the leading edge of the window. We (of the present) can move the exhaustion point nearer and farther by adjusting our consumption of the resource up and down. And we can (although more indirectly) move the arrival of the competitor technology back and forth, by investing more or less in the sorts of research endeavors that might bring it about. These two levers then give us some goodly measure of control over the creation of a gap. And this control, combined with the demands of justice towards those who might fall into the gap, gives us a powerful normative duty to insure that no gap is created.

The metaphor that suggests itself is of a bridge – the exploitation of exhaustible window resources is like the building of a bridge, from one technology period to another. The near bank is the onset of exploitation of the resource, the far bank its replacement by successor technology. What is needed is a bridge long enough to get safely to the other side. All of those who exploit

the resource are engaged in building the bridge, and they will only have done so successfully if no crosser falls into the gap between the end of the bridge and the far bank.

The metaphor extends to the harm in building a bridge halfway across a river. Those who attempt to cross over such a bridge have a special complaint against the builders for the harm they suffer, since it's a harm that would have been entirely avoided if they hadn't been tempted to attempt the crossing by the appearance of the bridge, and the implicit promise inherent in such a structure, that it will render one safely across. Those generations after us who live in a society that needs oil but lacks it due to our over-consumption are like our unfortunate crossers, they suffer harms that are particularly the fault of the bridge builders, because they wouldn't have suffered them at all if it weren't for the actions of those earlier generations that put them on that path.

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