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Just because an angel is better than a stone, it does not follow that two angels are better than one angel and one stone. So said Aquinas (*Summa contra Gentiles* III, 71), and the sentiment was echoed by Leibniz. In section 118 of the *Theodicy* he wrote: "No substance is either absolutely precious or absolutely contemptible in the sight of God. It is certain that God attaches more importance to a man than to a lion, but I do not know that we can be sure that he prefers one man to an entire species of lions." Even Kant was bitten by this bug. In one of his pre-Critical works he was moved to say, *à propos* of lice, that even though they "may in our eyes be as worthless as you like, nevertheless it is of more consequence to Nature to conserve this species as a whole than to conserve a small number of members of a superior species."[1]

In these passages Aquinas, Leibniz, and Kant gave expression to a distinctive and interesting view about the value of animal species and animal populations. At its simplest, this is the view that there is a special value in the existence of animal species or in the existence of a wide variety of different animal species. But the view also goes deeper than this. An animal species, after all, is nothing over and above the individual animals which make it up, and the value which it contributes to the world must therefore be some function of the values contributed by those individual animals. At the deepest level, what the view expressed by Aquinas, Leibniz, and Kant holds is that the value which an individual animal contributes to the world is not constant but varies with the number of other animals in his species. When the number of other animals in his species is small, his own existing contributes a fairly large amount of value to the world, and his passing out of existence deprives it of a fairly large amount of value as well. But when the number of other animals

* In the course of writing this paper I have benefited from the comments of John Leslie, Dennis McKerlie, John Heintz, J. J. MacIntosh, and two referees. Robert Woodrow and Verena Huber-Dyson helped me with some of the mathematics.

1. Immanuel Kant, *Allgemeine Naturgeschichte und Theorie des Himmels* (1755), in *Kants gesammelte Schriften*, 24 vols. (Berlin: Königlich Preussischen Akademie der Wissenschaften, 1902–66), vol. 1, pp. 215–368, p. 354. The quotations from Aquinas, Leibniz, and Kant are drawn from A. O. Lovejoy, *The Great Chain of Being* (Cambridge, Mass.: Harvard University Press, 1936), pp. 75, 225, 362.

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in his species is large, the issue of his existing or not existing is not nearly so significant.

Let us call the view expressed by Aquinas, Leibniz, and Kant the "variable value view"; I think this view is both an attractive one and one that many of us already adopt in our thinking about animal populations. Consider for instance our attitude to an endangered species like the whooping crane. If there were a large number of whooping cranes in the world, then I am sure none of us would think that the birth of another whooping crane was an event of any great significance or that the death of a whooping crane was something which it was worth spending any large sum of money to prevent. But things are different when the whooping crane population falls as low as sixteen. Then individual whooping crane births are widely reported in the international press, and large sums of money are spent both to encourage the births of new whooping cranes and to prevent the deaths of any existing whooping cranes. When we reflect that this same money could easily be spent on medical or safety facilities for humans and that if it was it could easily save a number of human lives, it is not at all absurd to suggest that, when the whooping crane population gets to be small enough, the value of an individual whooping crane life increases in our eyes to a point where it is not all that much smaller than the value of an individual human life.

Although Aquinas, Leibniz, and Kant applied the variable value view primarily to animal populations, the same view can also be applied to human populations. It will then hold that the value which an individual human being contributes to the world is not constant but varies with the number of other human beings in the world, being much larger when that number is small than it is when that number is large. This second application of the variable value view is also an attractive one, and I think it is also one that many of us already make in our thinking about human population increase. When we imagine situations in which the human population has been reduced to a mere handful of people, as it is in the biblical story of Noah, or as it might be in the event of a nuclear holocaust, one of the first things that springs to our minds is the tremendous importance of increasing that population and of starting to repopulate the world with humans. One of the principal duties of the handful of people who survived a nuclear holocaust would be to procreate, and we think this duty would be binding on them even if, as a result of limited supplies and resources, procreating would diminish their own well-being considerably. But when the human population gets to be as large as it is now, with some three or four billion people in the world, further increases in its size do not seem nearly so important to us. If it were possible to add to the present population of the world another five million people who would be just as well-off as existing people, and to do so in a way that did not make any other people worse-off, then I think many of us would regard the addition of these five million people as a good thing. But we would surely not regard it as a *very* good thing; and we would surely not

think that any *very* serious wrong had been done if the addition was not made.

The variable value view is not captured by either of the two consequentialist principles which are most commonly applied to questions about human population increase, namely, the average principle and the total principle, and this does a lot to explain why these two principles are so unattractive. The average principle is unattractive primarily because of its consequences at low levels of population. These are the levels at which we think population increases have the most value, yet the average principle gives them no value if they are not accompanied by an increase in the average well-being per person and a negative value if they are accompanied by even the smallest decrease in the average well-being per person.[2] The average principle's consequences at high levels are not nearly so unattractive, for, as we have seen, we do not think that population increases at these levels are nearly so important. But the consequences are still not entirely attractive. I think most of us believe that population increases at high levels have at least a little value, and if we do, we will have to regard a principle which gives them no value as one that goes a little too far. Unlike the average principle, the total principle has its most unattractive consequences at high levels of population. At these levels it gives far too much weight to population increases, and it continues to require these increases far beyond the point where most of us think they have ceased to be morally important. This can be brought out most strikingly by showing that the total principle is committed to accepting what Derek Parfit (perhaps following McTaggart)[3] has called the "repugnant conclusion." Let us try to imagine an ideal world, one in which there is an exceptionally large number of people at an exceptionally high level of well-being. Then if the total principle is correct there is another world which is better than this one, a world in which there is some much larger number of people at a much lower level of well-being, a level, in fact, at which their lives contain a barely positive amount of well-being and are therefore "barely worth living." This conclusion is, I think, rightly called repugnant, but a principle which gives as much value to population increases at high levels as the total principle does cannot avoid accepting it. The total principle's consequences at low levels of population are much more attractive, for at these levels the principle gives value to many population increases which involve a decrease, and even a significant decrease, in the average well-being per person. But it is once again open

2. Here as elsewhere in this paper I use "well-being" to refer neutrally to whatever state of human beings a consequentialist principle takes the value they contribute to the world to be a function of. For a utilitarian principle this state will be happiness, for a perfectionist principle some state of human perfection or excellence, and so on. The value human beings contribute to the world need not, of course, be a function only of their well-being. If that were the case, the variable value view would be ruled out from the start.

3. See J. M. E. McTaggart, *The Nature of Existence* (Cambridge: Cambridge University Press, 1927), vol. 2, pp. 452–53.

to question whether these consequences are entirely attractive. We have seen that population questions would take on a special urgency in the event of a nuclear holocaust, and it is not clear that a simple summative principle like the total principle can account for this special urgency. It is of course true that when the population level gets very low the survival of the human race is threatened, and that since the survival of the human race is a necessary condition of there being any value in the future the total principle will tell us to do a fair amount to ensure it. The trouble is that in this case a fair amount is not enough. Imagine that an all-powerful being (I hope I am not begging any questions when I call him the devil) offers us a wager which he says we have a .51 chance of winning and a .49 chance of losing. If we win he will make it the case that at any time in the future when there would otherwise have existed a certain number of people at a certain average well-being per person there will exist twice that number of people at the same average well-being; whereas if we lose he will cause the human race to die out. I think most of us would say we ought to reject this wager of the devil's; but the total principle says we ought to accept it.[4]

It is important to be clear about the exact nature of these difficulties for the average and total principles. I do not want to deny that the average and total principles will require many population increases at low levels of population and forbid many increases at high levels. They will require increases at low levels if these allow for a more extensive division of labor and thus greater economic productivity, leading to a greater average well-being per person (and also total well-being). And they will forbid increases at high levels if these place too great a strain on scarce resources, leading to a smaller total well-being (and also average well-being). In these cases the average and total principles will make judgments based on the *side effects* which increases in the human population will have on already existing people. The difficulties I have raised concern in the first place cases where these side effects do not obtain. I have argued that, even when population increases will have no effect on the average well-being, we think they are more important at low levels than at high levels, and that the average and total principles cannot capture this view. But

4. An adherent of the total principle may try several responses to this argument. He may say, first, that our refusal to accept the devil's wager does not show anything about our attitude to values, but only that we are extremely risk averse when the stakes are very high. But this seems to me perverse. Why attribute an irrational attitude to risk to ourselves when we can explain the same phenomena by simply allowing that we might have something other than the most simpleminded approach possible to the quantification of values? An adherent of the total principle may also say that we reject the devil's wager because we imagine that without it there may be an infinite number of human beings in the future, and twice infinity is still infinity. This response will not do, for the total principle can never consider the possibility of infinite future amounts of well-being. If it does, it will have to allow that any actions that have even the remotest probability of being followed by an infinite future amount of well-being—that is, just about any actions at all—have the same (infinite) expected value and are therefore all morally indifferent.

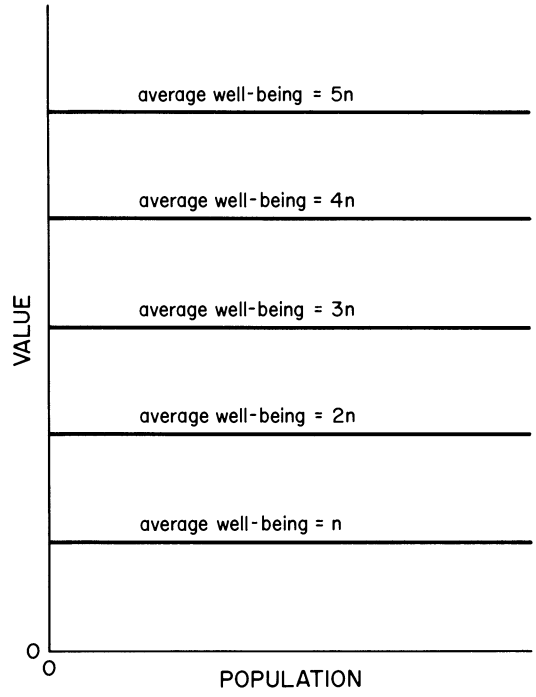

FIG. 1.—The average principle

the difficulties also extend to cases where the side effects do obtain. If the average principle gives too little weight to population increases at low levels when they do not affect the average well-being, it will also give too little weight to these increases when they do affect the average well-being; and the opposite holds (at high levels) for the total principle. Some adherents of the total principle have claimed that the human population is already so large that further increases in its size will lower the total well-being in the world, so that the total principle no longer requires us to make these increases. I think these claims are fanciful and that on any plausible assumptions the total principle will be requiring population increases for a good while to come. If this is the case, however, the total principle has unattractive consequences for choices we are making in the actual world today, with all possible side effects taken into account.

There are several consequentialist principles which do capture the variable value view as it applies to human populations, but in this paper I want to examine the two which I think are the most plausible. To do this I need to introduce a family of graphs, which I will call "population-value graphs." The vertical axis on one of these graphs measures the value which a human population contributes to the world (at a given time), while the horizontal axis measures the size of the population (at that time), and lines across the graph, or population-value lines, show

how the value which a population contributes to the world (at a given time) is a function of its size, given a fixed average well-being per person. Different consequentialist principles calculate the values measured on the vertical axis in different ways, but for simplicity's sake I will assume that they all then tell us to maximize the sum of these values across times. It may help to explain the operation of these graphs if we show how the two most familiar principles, namely, the average and total principles, can be represented on them. A population-value graph for the average principle contains a family of evenly spaced population-value lines which are both straight and horizontal (fig. 1). Since the average principle holds that the value which a population contributes to the world is independent of its size, a move to the right along one of these lines (a move which represents an increase in the size of the population without any change in the average well-being) is not accompanied by any vertical rise (which represents an increase in value), and the only way to achieve such a rise is to move to a line which represents a higher average well-being. The lines on a graph for the total principle, by contrast, do rise to the right (fig. 2). They are straight lines which begin at the origin and rise to the right, with the lines representing a higher average rising more steeply than those representing a lower average.

Now the fact that the average and total principles do not capture the variable value view is reflected in the straightness of the population-

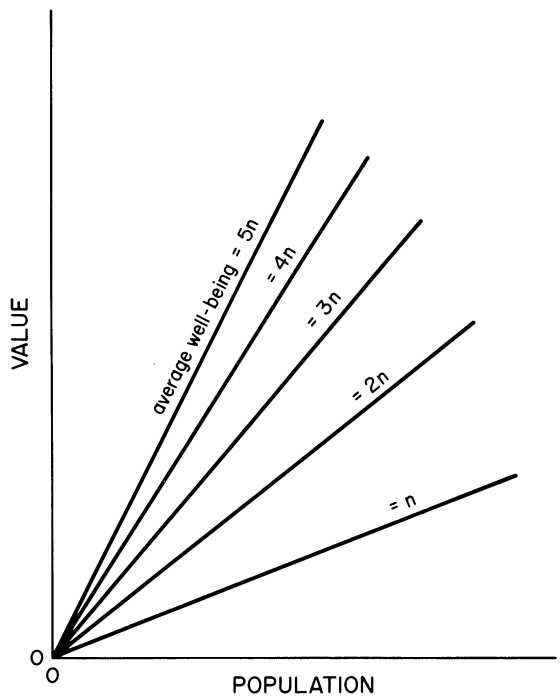

FIG. 2.—The total principle

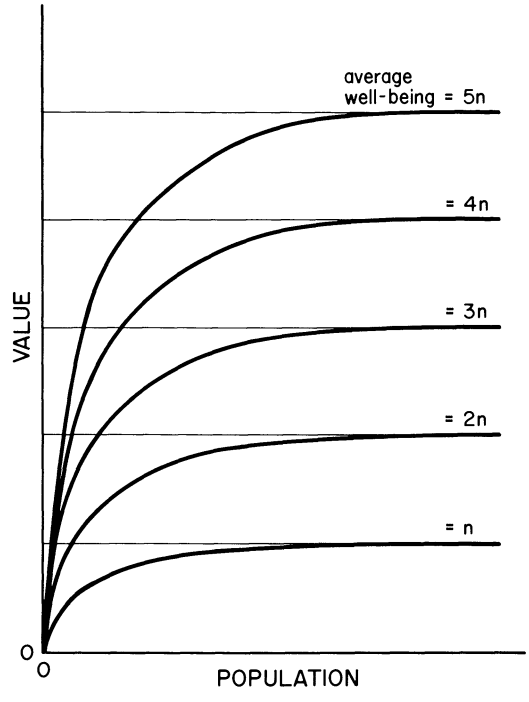

FIG. 3.—V1

value lines in figures 1 and 2. The way to capture the view is to give up the assumption that these lines have to be straight and to consider instead the possibility that they might be curves, in particular, that they might be curves which begin by rising quite steeply from the origin and then flatten out as they move to the right. One attractive such possibility is represented in figure 3, in which every population-value line begins by rising steeply from the origin (much more steeply, it should be noted, than the corresponding line on the graph for the total principle) and then flattens out to converge on a horizontal staight line, a line to which it is therefore asymptotic.

Because of the way in which it captures the variable value view, the principle represented in figure 3 (let us call it V1) avoids many of the unattractive consequences of both the average and total principles. At low levels of population V1 gives more value to population increases than either of these principles, and it therefore does more to capture the urgency that would attach to population questions in the event of a nuclear holocaust. At the same time, V1 tells us to reject the devil's wager. Since the population-value lines it generates flatten continuously as they rise to the right, V1 holds that a doubling of the population size which is not accompanied by any change in the average well-being never does as much as double the value contributed by the population, and it

therefore holds that we should not accept the devil's wager unless the chances of our winning it are made somewhat better. If the population is not going to rise above a handful of people in the future, then our chances will not have to be made very much better; but if it is going to be very large in the future, say as large as it is now, then they will have to be made very much better indeed. The principle V1 also avoids the unattractive consequences which the average and total principles have at high levels of population. In particular, while holding with the total principle that of any two populations at the same average well-being the larger one is always the better one, V1 avoids the repugnant conclusion. Since the population-value lines in figure 3 are asymptotic to horizontal lines, V1 says there is an upper limit on the value which a population at a given average well-being can contribute. If the "ideal" world we imagine has more value than the upper limit for worlds in which everyone's life is "barely worth living," as it is surely certain to do, then V1 says we cannot improve on this world by moving to another in which everyone's life is "barely worth living," no matter how many people that second world contains.[5]

Although V1 accepts the variable value view as it applies to population size, it does not accept any similar view about the average well-being but holds with both the average and total principles that, given a constant population size, the value of a fixed increase in the average well-being is itself always constant, so that a doubling of the average well-being which is not accompanied by any change in the size always doubles the value contributed by the population. This is reflected in the even spacing of the asymptotes in figure 3, which ensures that whenever we move from a point on a line representing one average well-being to the point directly above it on the line representing twice that average well-being, we always arrive at a point twice as far up the graph as the one from which we started. But a consequentialist principle can also apply something like the variable value view to the average well-being and make the value of a fixed increase in the average get smaller as the average gets higher. A principle which does this is represented in figure 4, in which the asymptotes are no longer evenly spaced, but draw closer together the farther we move up the graph.

The principle represented in figure 4 (let us call it V2) has similar consequences for questions about population increase as V1, but there are at least two respects in which I think it is more attractive than V1 (for a third, see below). As we have seen, V1 holds that a doubling of the population size which is not accompanied by any change in the

5. Consider a principle which is like V1 except that it generates population-value lines which are asymptotic to lines which rise slightly to the right. Although this principle gives much less weight to population increases at high levels than the total principle does, it is still committed to accepting the repugnant conclusion. This is sufficient, I think, to make it a less attractive principle than V1.

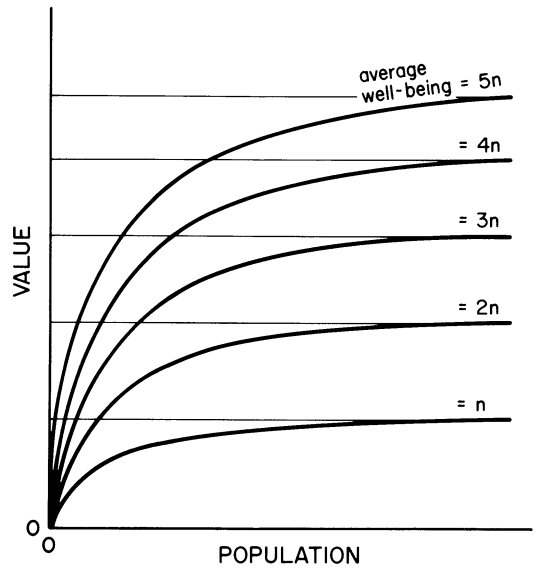

FIG. 4.—V2

average well-being never does as much as double the value contributed by the population; but, at the same time, it holds that a doubling of the average which is not accompanied by any change in the size always doubles that value. This means that, given a choice between (merely) doubling the average and (merely) doubling the size, V1 always tells us to (merely) double the average. If we attach great value to population increases at low levels, we should find this an unattractive consequence and should take it as a reason for preferring a principle like V2, which sometimes tells us to (merely) double the size. The second respect in which V2 is more attractive than V1 concerns another wager of the devil's, which we once again have a .51 chance of winning and a .49 chance of losing. If we win, the devil will make it the case that, at any time in the future when there would otherwise have existed a certain number of people at a certain average well-being, there will exist the same number of people at twice that average well-being; whereas if we lose, he will cause the human race to die out. If we think we ought to reject this wager, as I think many of us will, we should hold it against V1 that, like the average and total principles, it tells us to accept it. The principle V2, however, tells us to reject the wager.

Whatever the differences between V1 and V2, they are less important than the fact that they both capture the variable value view, and both avoid many of the unattractive consequences of the average and total principles. However, V1 and V2 are open to at least two objections which are worthy of examination. To approach these objections let us

consider two worlds, which we can call W and W+. World W contains a certain number of people at a certain average well-being, while W+ contains the same people at the same average well-being, plus some extra people at a lower average well-being. Which of these two worlds is the better one? Since W has a higher average well-being the average principle will always prefer W, and since W+ has a greater total well-being the total principle will always prefer W+. But V1 and V2 will sometimes prefer W and sometimes prefer W+. If the population in W is very small, and the average well-being in W+ is not all that much lower than in W, V1 and V2 will probably prefer the larger world W+. But if the population in W is very large, and the average in W+ is quite a lot lower than in W, they will probably prefer the smaller world W.

Now if V1 and V2 sometimes prefer W to W+, they will sometimes forbid us to move from W to W+ by adding the extra people in W+. The first objection claims that this is implausible. World W+, it says, contains everything that W contains and differs from it only by a "mere addition." And how can a mere addition make a world worse than it was before?

This mere-addition objection is often thought to have devastating force against the average principle,[6] but there are two considerations which give it less force against V1 and V2. The first is that V1 and V2 do not forbid nearly as many mere additions as the average principle does and, in particular, do not forbid the mere additions at low levels of population which it would be most implausible to forbid. This is especially true of V2. Since V2 makes the value (and disvalue) of changes in the average well-being diminish to zero as the average well-being gets higher, it forbids many fewer mere additions at high averages than V1 does, and as far as I can see, it hardly forbids any mere additions at high averages at all. The only mere additions which V2 clearly forbids are those which start from a fairly large population at a fairly low average well-being per person; and these are the mere additions which I think it is the least implausible of all to forbid.

The second consideration only applies if we interpret "well-being" not as happiness but as involving the achievement of some form of human perfection, as Aquinas, Leibniz, and Kant all interpreted it, and as I would want to interpret it as well. When we make judgments involving perfectionist (as opposed to utilitarian) values, we often do object to (at least some) mere additions. Consider, for instance, the judgments we make about careers. Many of us think Muhammad Ali's boxing career, to take a current example, would have been better without those last fights against Larry Holmes and Trevor Berbick. This is not because we

6. E.g., by R. I. Sikora, "Is It Wrong to Prevent the Existence of Future Generations?" in *Obligations to Future Generations*, ed. R. I. Sikora and Brian Barry (Philadelphia: Temple University Press, 1978), pp. 112–66, p. 116.

think Ali's performances against Holmes and Berbick were by some objective standard bad; we know that, for many other boxers, to do as well as Ali did against these fighters would have marked the pinnacle of their careers. It is rather because we think Ali's performances were so much worse than the performances he produced in his prime that it was bad *for him* to produce them. The Holmes and Berbick fights were mere additions to Ali's boxing career, yet many of us think his career would have been better without them. A similar attitude is present in the judgments many of us make about collections. Consider a collection of 100 exceptionally fine paintings, and then consider the collection which results when it is expanded by the purchase of twenty-five utterly mediocre paintings. If we think the second collection is worse than the first, as I am inclined to myself, then we should not automatically object to a theory which says that, given a world containing 1 billion people leading active, challenging, and autonomous lives, we make that world worse if we add to it 250 million extra people leading mindless, passive, and conditioned lives.

I would not want to say that these two considerations provide a complete answer to the mere-addition objection, even for the most favored principle, namely, a perfectionist version of V2. But I do think that together they provide a fairly good answer; and when we remember that the cost of providing a complete answer is accepting the repugnant conclusion, I think they provide an answer that is more than good enough.

If V1 and V2 sometimes prefer W to W+, they will also, if taken on their own, sometimes require us to move from W+ to W by killing the extra people in W+ or by allowing them to die if they are in danger from which we could save them. The second objection claims that these consequences, which concern population decrease rather than population increase, are simply unacceptable.

This second objection is also often thought to have devastating force against the average principle, and it is certainly not an objection that we can answer by showing that V1 and V2 require a little less killing than the average principle or by pointing to some differences between perfectionist and utilitarian values. If I still do not think the objection has much force against V1 and V2, it is because I think consequences of the kind it points to are not peculiar to V1 and V2 but will follow from any consequentialist principle if we try to take it on its own. Consider, for instance, the total principle. Although this principle gives much more weight to population increases at high levels than V1 and V2, it still has notoriously unattractive consequences about killing and allowing to die. As its critics often point out, the total principle taken on its own would require us to kill innocent persons or allow them to die whenever this enabled us to replace them with slightly better-off persons, and it would require killing and allowing to die in many other unacceptable circumstances as well. Some adherents of the total principle have tried to avoid these unattractive consequences by adopting a supplementary principle

forbidding us to interfere with the autonomy of others,[7] but while this autonomy principle may avoid some of the consequences about killing it does not avoid those about allowing to die. I am not sure exactly what supplementary principles are required if a consequentialist principle is not to have unacceptable consequences about killing and allowing to die, but I am sure that, whatever they are, they are required just as much by the total principle as they are by V1 and V2. It is foolish to think that the consequentialist principles we use to assess the values of different populations could ever be the only principles in an acceptable moral theory. They have to be accompanied by supplementary principles setting constraints which we must not violate while pursuing our population goals and which we must not violate in particular by taking the lives of existing people. If we are to assess population principles *as population principles*, then we must assess them in circumstances where these constraints do not apply, that is, in circumstances where only increases and not decreases in the human population are in question. And when we do assess them in these circumstances, I think we find that V1 and V2 are the most attractive population principles that can be devised.

7. See, e.g., Jonathan Glover, *Causing Death and Saving Lives* (Harmondsworth: Penguin Books, 1977), pp. 71–72; and Peter Singer, *Practical Ethics* (Cambridge: Cambridge University Press, 1979), pp. 83–84.