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Population

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How many people are there?

While people have been concerned about human population growth for thousands of years, the existence of what we would now consider large human populations is a relatively recent phenomenon: the human population of the earth did not reach the first billion until the early nineteenth century – long after the publication of Thomas Malthus's famous *Essay on the Principles of Population* in 1798. Population did not reach two billion until the early twentieth century (between 1925 and 1935). The third, fourth, and fifth billions arrived around 1960, 1975, and 1990 respectively, the sixth arriving with the new millennium.

Most estimates put the current (turn of the century) human population of the earth quite near 6 billion. The present rate of population growth, however, is between 1.6 and 1.7 percent per year. If that rate of growth were to remain stable, we would expect an additional billion people in about ten years, and would expect the current population to double in size in less than fifty years. However, while most demographers expect population size to continue to grow well into the twenty-first century, many also predict that the *rate* of growth will decline during the next twenty years, and that world population may even stabilize at some time during the mid-twenty-first century. There is little agreement, however, about what mechanism is likely to cause the rate of growth to diminish, or about the population levels that may be achieved before we reach stability or decline in total population size. Some argue that human population is likely to keep growing until environmental destruction and consequent resource scarcity causes widespread famine, bringing the death rate high enough to compensate for the birth rate. Others more hopefully propose that fertility rates may fall as economic and human development give people (and especially women) more control over their reproductive lives.

Is the increase in human population a problem, and if so, what kind of problem is it? Concerns about population growth usually identify the problem in one of two ways: first, human population growth may imply proliferation of destitution and misery for present and future generations of human beings. Some theorists have argued that population increase will go hand in hand with increasing poverty, since there will be less of everything to go around. But those who find this view untenable may still have a (second) good reason to be concerned, since the growing human population may unsustainably exploit resources and destroy the earth's great ecosystems. There is a third important reason why population

growth and high human fertility should be regarded as a serious problem: the high fertility rates that lead to rapid population growth impose inordinate personal costs and an unacceptably high risk of death on women in their reproductive years.

Important elements of the current population debate were first articulated in an exchange between the Marquis de Condorcet and Thomas Malthus at the end of the eighteenth century. I begin by exploring the main themes in this exchange, tracing the influence of this classical debate in contemporary theories of population, and examining the role these theories play in development economics, including consideration of the policy implications of contemporary theories. Next I discuss paradoxes that arise when we try to use common normative criteria to evaluate potential changes in population. Finally, I consider the significance of population growth for environmental philosophy and policy.

Classic discussions of population: Condorcet and Malthus

In 1793, Antoine-Nicolas, Marquis de Condorcet argued that the advancement of science and knowledge will lead to the continued improvement of human institutions, and that the human condition will approach perfection as our knowledge increases. Even the length of human life, claimed Condorcet, may be expected to approach infinity as knowledge of medical science becomes more perfect. Since increasing population size poses a potential threat to improvement, he considered the likelihood that the number of people in the world might eventually exceed the means of subsistence, and that this might lead either to "a continual diminution of happiness and population," or alternately to "an oscillation between good and bad" which would be "a perennial source of more or less periodic disaster." This problem, argued Condorcet, will be solved once

> the absurd prejudices of superstition will have ceased to corrupt and degrade the moral code by its harsh doctrines instead of purifying and elevating it. We can assume that by then men will know that if they have a duty towards those who are not yet born, it is not to give them existence but to give them happiness; their aim should be to promote the general welfare of the human race or of the society in which they live or of the family to which they belong, rather than foolishly to encumber the earth with useless and wretched beings. (Condorcet 1955 [1793], p. 189)

It is usually assumed (for example by Malthus) that by "the absurd prejudices of superstition," Condorcet meant to refer to puritanical attitudes toward the use of birth control. It is clear enough that this was at least part of his intent. But in the context of the *Sketch*, it is plausible to read him as meaning more than this: Condorcet believed that the progressive improvement of knowledge and human institutions, including especially the recognition of fully equal rights for women, would lead people to have greater control over their lives generally. Voluntary fertility reduction would, he believed, be a natural consequence of these improvements. It is because of this broader project that Condorcet is usually associated with the view that fertility

reduction will naturally follow from human development and improvement in the conditions of life.

It was largely in response to Condorcet's *Sketch* that Thomas Malthus wrote the first edition of his *Essay on the Principles of Population* (1798). In this work (usually called the *First Essay*) Malthus argues that human population will increase geometrically until checked by some countervailing force, while the "means for subsistence" can be expected to increase only arithmetically. Because of this, the size of the human population will grow until it eventually reaches a plateau when the earth's capacity to meet needs has been stretched to its extreme limit. At this point, it will stabilize as starvation causes the death rate to rise to the level of the fertility rate. If the means of subsistence increase (due, perhaps, to colonization of new territories or increase in productive efficiency) population will again rise to a new famine equilibrium. Malthus recognized two categories of check on population growth: "positive checks" are causes of increased mortality, while "preventive checks" are the causes of decreased fertility. Elsewhere in the *First Essay*, he argues that these checks, both positive and preventive, "may be fairly resolved into misery and vice." When starvation, disease, or war increase the death rate, population is checked by misery. Of the other category, he remarks that "Promiscuous intercourse, unnatural passions, violations of the marriage bed, and improper arts to conceal the consequences of irregular connections are preventive checks that clearly come under the head of vice" (Malthus, 1989 [1803], p. 18).

Puritanical Malthus was shocked by Condorcet's suggestion that birth control would allow people to gain more rational control over their reproductive lives. But in later editions of the *Essay* he added "moral restraint" as a third category of preventive check, if people can acquire the moral fortitude to abstain from marriage and from "irregular gratifications." Still, Malthus seems to have regarded this last check as much too weak to counteract the forces leading to rapid population growth. So population should be expected to rise to the level permitted by the availability of "means of subsistence," at which point "misery and vice" will bring this growth to a stop. Even then, "misery" will be the most prevalent check on population growth, since "vice" is not very effective as a means of fertility reduction while starvation and deprivation can be cruelly efficient causes of increased mortality.

While this analysis was already quite bleak enough, it was his prescriptions for policy that brought Malthus undeserved notoriety as a gloomy misanthrope. He saw efforts to ameliorate poverty as doomed to ultimate failure since they must ultimately cause an increase in population and a consequent increase in misery and suffering. Improving the conditions of life for the poor, he argued in the *First Essay*, simply facilitates faster rates of reproduction, leading to a new and more populous famine equilibrium at a later date. Malthus's views have often been dismissed as "cruel," but his express aim was to describe policies that would minimize human misery. It can hardly be acceptable simply to argue that such a view is cruel: it must be shown that there are alternative policies that are likely to do better. While contemporary theorists have improved upon Malthus's analysis, key elements of his theory have yet to be disconfirmed.

The contemporary debate: population, development, and the environment

The Malthusian view of the population problem is still prevalent in popular discussions of population, and many still see the Condorcet–Malthus exchange as having set out the essential elements of the current debate. Two fundamental features of Malthus's analysis are carried on in contemporary discussion: the Malthusian view that resource availability sets limits to growth is carried on in the contemporary notion of a "carrying capacity" for the earth. And Malthus's insight that fertility should be analyzed in terms of the factors that influence individual decision-making is carried on in economic models of fertility. While Condorcet's enlightenment optimism has few contemporary adherents, an important insight of his analysis has been resurrected in recent work on population and development: as Condorcet implies, the best way to reduce fertility may well be to improve the circumstances of life for the poor and to work to guarantee equal opportunities for women. Environmental philosophers should pay particular attention to this insight, since it implies that human development must be a centerpiece of any effective plan for global environmental protection.

Carrying capacity

The concept of "carrying capacity" was developed by ecologists, who have used it to refer to the Malthusian notion of an upper limit on population size set by the availability of resources. One way to estimate the carrying capacity of an environment is as follows: first estimate the quantity of renewable resource necessary to support an individual organism (whether human or non-human). Then estimate the total quantity of renewable resources available. The carrying capacity of this environment is determined by dividing the total quantity of renewable resources by the quantity needed to support an individual organism.

So understood, the carrying capacity of an environment represents the maximum population level that can possibly be held stable over time. However, this possibility is only theoretical, not practical: once carrying capacity is reached, it can be held stable only if each organism consumes just barely enough to stay alive. Since such perfectly egalitarian distribution is as unlikely in non-human populations as it is in human populations, it is not practically possible to hold the carrying capacity maximum as a stable equilibrium. It would be far better for each organism if population could stabilize far below the carrying capacity limit. However, on this conception, environmental carrying capacity can even be *exceeded* for limited periods of time, while non-renewable resources are used up, or when renewable resources are consumed faster than they can be renewed. Such over-exploitation is bound to be followed by a "crash," during which resource scarcity and consequent increased mortality (Malthus's "misery") will reduce population to a level that can be supported. The dynamics of population growth and decline can be represented by a "flow chart" such as that given in Figure 25.1. Some, like the biologist Garrett Hardin (1993), continue to make the case for the Malthusian view by applying the notion of a carrying capacity to the human population of the earth.

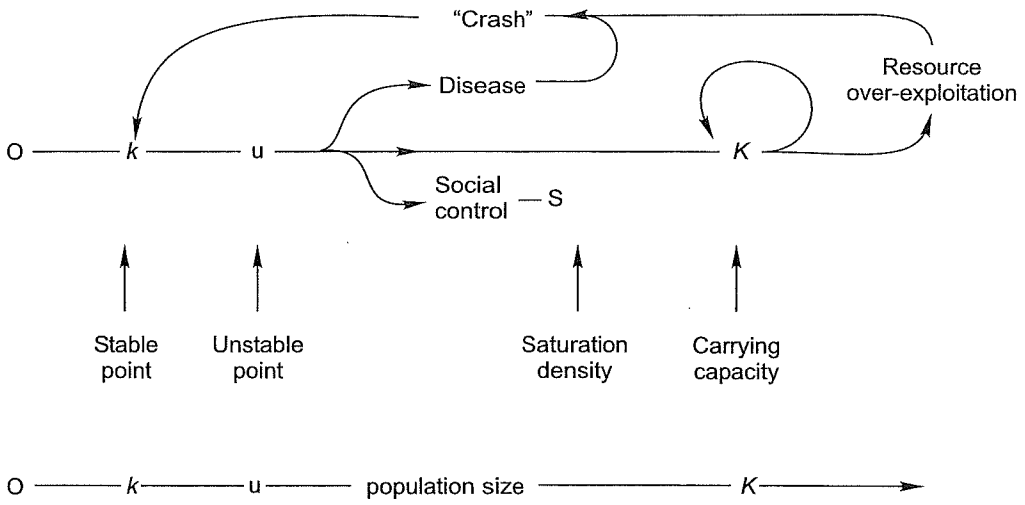

Figure 25.1 Carrying capacity understood in the context of population dynamics: "As population size increases from left to right, the population may reach one of two equilibria; k is the population size set by predation, while K is set by resources. Social control might cause a stable population to be maintained below K. Resource over-exploitation or disease might cause a population crash."
Source: Ron Pulliam and Nick Haddad, 1994, "Human Population Growth and the Carrying Capacity Concept." *Bulletin of the Ecological Society of America* 75 (1994)

But this conception of environmental carrying capacity was originally developed for demographic analysis of *animal* populations, and may not be easily applied to human populations. One reason for this is the ambiguity of the term "resource." Resources are not homogeneous, as the account above suggests, and in important respects resource availability is a function of technology. In particular, resource availability can vary when new technologies increase or decrease productive efficiency. Fertilizers can increase crop yields, shifts to reliance on new sources of energy may change energy needs, and improved communications systems may reduce travel needs. With technological change, we may be able to find substitutes for resources on which we now rely. For these reasons, the "human carrying capacity of the earth" is not a fixed quantity as the model above implies: carrying capacity varies with technology and with changes in productive efficiency (see ECONOMICS, CONSUMPTION).

Contemporary technological optimists rival Condorcet in their confidence that reason and human creativity will enable us to increase the carrying capacity of the earth so that shortages will not be a significant problem for the much larger human populations to come. Such considerations have led some to reject the notion of a "carrying capacity" altogether, since people themselves may be considered a resource for others. On this view, resources necessarily increase as populations grow, and the notion that resource scarcity could result from population growth becomes unthinkable. A moderate version of this view is reflected in ex-US President George Bush's observation that "Population growth itself is a neutral phenomenon . . . every human being represents hands to work, and not just another mouth to feed" (quoted in Cohen 1995, p. 38). A more extreme version is found in the work of the economist Julian Simon, who, like Condorcet before him, follows this technological optimism to

its logical extreme: since human creativity is an "infinite" capacity, the set of resources available to human beings must itself be infinite. Applied to an infinite resource base, the account of "carrying capacity" given above implies that population may also grow infinitely. Population growth, urges Simon (1996), should not be inhibited. It should be encouraged.

While this optimistic view is often dismissed out of hand by economists and environmentalists, it is not all wrong, and it continues to have great influence in discussions of population. Simon is right to point out that the term "resource" is ambiguous, and that the earth's "carrying capacity" may increase (or decrease) with technological change. The ecological conception of carrying capacity, so useful in its application to animal species, may not neatly describe the demographic behavior of our own species. But neither creativity nor resources are "infinite" in the sense implied by Simon, and it would be premature to conclude that the carrying capacity concept is irrelevant for the analysis of human populations. For example, there is evidence that when fertility is higher, fewer resources are spent on education and nutrition for each child (Nancy Birdsall, in Lindahl-Kiessling and Landberg 1994, p. 178). If creative innovation requires education and resources, then there is reason to believe that per capita productivity may decrease as fertility and population size increase, as J. S. Mill (1806–73) predicted long ago: "It is vain to say that all mouths which the increase of mankind brings into existence bring with them hands. The new mouths require as much food as the old ones, and the hands do not produce as much" (J. S. Mill, *Principles of Political Economy*, Book 1, ch. XIII).

Beyond these internal problems with the optimistic view, there are external problems as well. Some "resources" are indispensable, and it is unlikely that technology will provide adequate substitutes (breathable air, for example). Others are valued in themselves, independently of their contribution to human well-being (ecosystems and wildlands). Their loss could not be compensated by replacement technologies, and we may have good reason to preserve and protect them independently of their contribution to human well-being. Even if the needs of an enormous human population could somehow be met without the earth's great natural systems, we would still have good reason to prevent environmental destruction (see NORMATIVE ETHICS).

The concept of carrying capacity will require revisions before it can be neatly applied to human populations. Still, those who are unconvinced by Condorcet's case for the infinite prospects for human reason and the perfectibility of the human condition will recognize that human and environmental limitations do ultimately impose upper limits on human population size, as Malthus recognized. For these reasons, it is quite clear that the concept of carrying capacity has continued relevance to issues concerning human population growth, and that it will be valuable to develop a conception of "carrying capacity" that is more readily applicable to human populations (Cohen 1995).

Focus on individual fertility decisions

A second Malthusian insight that retains considerable influence in contemporary discussions of population is that demographic change should be studied with an eye to the determinants of individual fertility decisions. While Malthus himself spent large

portions of his later work investigating the factors that influence people's individual reproductive choices, Gary Becker and H. G. Lewis (1976) may be credited as the first to develop this Malthusian insight into a full theory by representing reproductive choice using the tools of microeconomic analysis. Becker and Lewis represent children as "consumer goods," and hypothesize that parents will "consume children" at efficient rates (that is, they will have an "efficient" number of them) balancing "quantity," the number of children they will have, against "quality," reflected in the resources they will be able to provide for their children. They assume that children who are provided with more resources will be "better children," and more satisfying to their parents. On these assumptions, it is possible to show that rational parents will make "optimal" choices, likely to benefit children and parents alike.

In spite of its virtues, the Becker–Lewis model does not provide any analysis of the criteria parents use in evaluating the "quality" of their children. They assume that the benefits children provide for their parents are primarily the "psychic benefits" of seeing their children prosper. This may reflect fertility choices in developed countries like the United States, but it leaves out a crucial fertility motive operant in developing countries, where children provide the primary means for old-age security. The difference matters a great deal, for if parents' concerns are primarily self-regarding (desire to have children who can and will support parents in old age), they will make quite different decisions from what they would if their concerns were altruistic (desire to see children prosper). The extent to which parents' rational decisions will reflect the interests of their children may thus be contingent on childhood mortality rates, on the likelihood that children will support their elderly parents, and on the existence of alternate means of economic security for the elderly. In less developed countries, where childhood mortality is high, where cultural norms assign children weighty obligations to care for their parents, and where there are no effective institutions providing support for older people, it may be rational for parents to have as many children as possible in order to maximize the likelihood that they will have children to care for them in old age. On the other hand, in developed countries where childhood mortality is low, where children do not generally bear financial responsibility for their parent's well-being, and where many people prepare financially for their retirement, parental choices may reflect the interests of children as suggested by Becker and Lewis.

The most helpful insight to come from this model of reproductive choice is that parents' reproductive decisions may be influenced by increasing the opportunity cost of fertility. The opportunity costs of a choice are measured by the value of the options one sets aside in making it. So the opportunity costs of fertility are measured by the value of the opportunities parents will be unable to use if they have additional children. The income that might have been gained if parents were wage-earners rather than child-caretakers is only one kind of opportunity cost of fertility. While programs such as China's one-child policy raise the direct costs of fertility by punishing parents and children alike, alternatives that provide parents with employment and social security improve their welfare, thus increasing the opportunity cost of fertility. When these opportunity costs are high, it is far more likely that parents will make reproductive choices with the welfare of their prospective children in mind. In

such circumstances, it is far more likely that parents will choose to have fewer children and to provide each with a better start in life.

Among the most effective means for increasing the opportunity cost of fertility are the improvement of educational and employment opportunities for women, promotion of women's autonomy, and elimination of sexist barriers to equal opportunity. These means are desirable for their own sakes as well as for their implications for population. High fertility rates impose excessive burdens on women, including high mortality rates due to the stresses of pregnancy and childbirth as well as the labor involved in childcare. In most developing countries, maternal mortality is the largest single cause of death for women in their reproductive years: the maternal mortality rate in some areas in sub-Saharan Africa is as high as one in fifty. Since women in these areas typically have seven or more children during their reproductive years, the chance for each woman that she will not survive those years is about one in six. Partha Dasgupta grimly remarks that the reproductive cycle in this woman's life involves her "playing Russian roulette" (Partha Dasgupta, in Graham-Smith 1994, p. 157). This tragic state of affairs has hopeful implications for fertility policy, since fertility rates tend to fall toward stable levels when women have better opportunities for education and employment, access to effective birth control, and more autonomous control over their reproductive lives.

Here, Condorcet's hopeful analysis seems to have been correct: as he suggested, the best way to implement policies for fertility reduction may be to improve the conditions of life for the worst off members of society, and to work toward social and economic equality for women. Malthus was wrong to think that fertility will always increase when people are better off. Development theorists have taken Condorcet's hypothesis seriously, and have confirmed the causal connections among the problems of social inequality, poverty, women's rights, fertility, and environmental degradation. High fertility rates typically exacerbate poverty and social inequalities since fertility is strongly linked to affluence and class differences. In some developing countries, the fertility rate of the poor is twice that of the wealthy. Combined with data showing that fewer resources are used to provide for children in large families, this statistic reflects exacerbation of both poverty and social inequality, which in turn contribute to increased rates of environmental destruction. The popular slogan "Development is the best contraceptive" expresses Condorcet's optimism that this cycle may be broken by policies that improve the conditions of life for women and for the poor. Since we have good independent reasons for pursuing development efforts of this kind, this is a hopeful conclusion.

Fertility and development

The success or failure of this conclusion depends, however, on the nature of the development process. Economist Simon Kuznets famously hypothesized that initial income inequalities resulting from early stages of economic development should gradually level out as the benefits of economic prosperity are more broadly distributed. Frank Notestein proposed a corresponding hypothesis that fertility rates in developing countries will initially spike upwards, but that they too should level off or even decline as the changes due to economic development lead couples to choose

smaller families. This second hypothesis (the "Notestein Demographic Transition Hypothesis") is based on the assumption that effective economic development will raise the opportunity costs of having children, since children will be selected among a broader range of desirable alternatives. Economic development is also supposed to diminish the motive to have children as protection for old-age security, as social institutions provide alternate means for protection of well-being in old age.

But like many efforts in "ideal theory," these optimistic economic hypotheses seem to apply poorly to the real world. As Lester Brown notes, many developing countries seem trapped in the second stage where fertility spikes upward, but are "unable to achieve the economic and social gains that are counted upon to reduce births" (Brown et al. 1987, p. 20). Perhaps it is the failure of Kuznets's hypothesis that explains the failure of Notestein's Demographic Transition Hypothesis: fertility rates do not fall in the poor sectors of the population, because the purported benefits of economic development are often not distributed widely within the population, and because economic development often increases social inequalities instead of alleviating them, when a powerful minority manages to reap the economic benefits.

What explains the frequent failure of Kuznets's hypothesis? No single explanation may apply in all cases where development has failed to improve the welfare of the poor. But there may be institutional barriers that were not adequately taken into account by optimistic development theorists: it is often in the interest of those who become wealthy in the early stages of the development process to do what they can to prevent the benefits of economic prosperity from being more widely distributed. In many cases, high profit margins and low production costs depend on the existence of a large and impoverished labor force. Furthermore, those who have an economic interest in perpetuating social and economic inequalities are often the same people who have power over social institutions, and can effectively put in place barriers that retard or prevent a broader distribution of development benefits. Thus we might expect to see the prosperous and the powerful working to thwart efforts to improve general welfare, and resisting efforts to more widely distribute democratic control of political institutions. When economic development does not bring the expected benefits for an impoverished majority, fertility and maternal mortality rates should not be expected to fall. Increasingly large and densely packed human populations in turn lead to increasing rates of environmental exploitation and destruction. This may explain much of what we see when we look at the developing world.

Unless development improves the lives of the poor, it is unlikely to have desirable effects on human fertility or population growth, nor is it likely to decrease the rate of environmental destruction. These considerations suggest an alternative model for development, quite different from the "top-down," large-scale industrial strategy that has traditionally been favored by organizations like the World Bank and the International Monetary Fund. Development projects that import large industries into developing regions rarely reduce social inequality, since the benefits may not "trickle down" to those who need them most. Such "development" sometimes makes the poor even worse off, since it can be highly destructive to traditional small-scale economies and ways of life. An alternative "bottom-up" approach would focus on improving the opportunities of the poor instead of focusing on industrial growth or increasing GNP.

If human development is sacrificed to economic development, fertility levels are unlikely to decrease.

Policies aimed specifically at population control have often been repressive, and have had high social costs. Amartya Sen (1994) distinguishes between "Collaboration" and "Override" as alternative strategies for addressing the population problem: the former changes fertility incentives by increasing opportunities, while the latter operates by limiting people's ability to make their own choices or by punishing those who have more children than policies permit. China's aggressive efforts to control population by imposing punitive sanctions on couples who exceed their quota of children is a prime example of a coercive strategy. Not only do such strategies penalize parents and their children, they are also likely to be less effective in the long run: when population policies are repressive, it is in each person's interest to attempt to skirt them and to avoid their effects and costs. In societies marked by traditional sexism, the costs of coercive policies are likely to fall most heavily on women. In China, this is reflected in the marked rise in female mortality rates following the imposition of family quotas. But when population policies endeavor to provide people with incentives and opportunities, to raise the opportunity cost of fertility, then lower fertility becomes individually rational. Three kinds of collaborative measure for fertility reduction are most clearly implied by this strategy of increasing the opportunity costs of fertility:

1. Efforts to expand women's educational opportunities are likely to have the effect of lowering fertility. Such access will not only improve women's employment prospects, but will also result in later marriage and reproduction so that each is likely to have fewer children overall.
2. Efforts to provide women with employment opportunities can have a similar effect: when women are prohibited from work, as they have traditionally been in much of the world, the opportunity costs of fertility are extremely low. Generally increased economic opportunity for both women and men will increase the opportunity cost of children, but since women have suffered radically diminished opportunities in every culture and every country in the world, and since women are still the primary caretakers for children worldwide, it is especially important to expand opportunities for women (see ECOFEMINISM).
3. Since the need for old-age security is a prime incentive to have children in most developing countries, institutions that increase the economic security of the elderly remove an important destructive incentive to have children. The motive to have children to provide for one's old age is destructive in the sense that it passes costs on to the succeeding generation, whose interests are not adequately represented in the decisions of their parents. There is empirical evidence that old-age pension and effective social security systems do indeed reduce fertility.

The account of the population problem given here has not emphasized the distribution of contraceptives as a means for population control, but of course the availability of contraceptives can be crucial for people's autonomous control over their reproductive lives. Where policies aimed at human development are accompanied by increased access to contraceptives, they will be more effective. But when efforts to control population growth focus on the distribution of contraceptives at the

expense of attention to human development, they are unlikely to be effective, and are likely to be viewed with skepticism by those they are intended to help.

Population and moral theory

While population is a pressing practical problem, the articulation of sensible aims for population policy also raises serious theoretical difficulties: all contemporary moral theories and economic theories of social choice have paradoxical implications when they are used to evaluate population change or to compare prospective future populations. While these are problems for all moral theories, they can be most clearly presented as difficulties for utilitarianism.

In the context of population theory, it becomes necessary to distinguish between total and average versions of the utilitarian doctrine: according to total utilitarianism, the total surplus of happiness over misery should be as high as possible. To find this total, we simply add the utility levels of everyone together in one aggregate value. According to average utilitarianism, the average surplus of happiness over misery should be as high as possible. To find the average utility level, the total level is simply divided by the number of persons. Both versions of utilitarianism face daunting problems: total utilitarianism would force us to accept the "Repugnant Conclusion" that for any finite population of people who are all very well off, there is some much larger population of people all of whom have lives that are scarcely worth living, such that the latter is better than the former because the sum total of utility is greater (Parfit 1984, ch. 17). The average view implies that it would be wrong to have a child whose welfare level would be below the average level, no matter how high the average welfare level happens to be. On this view, the better off others are, the less likely it will be that having a child would be morally permissible. While many find these implications implausible, there is little agreement on how moral theories and economic theories of social choice should compare different prospective populations.

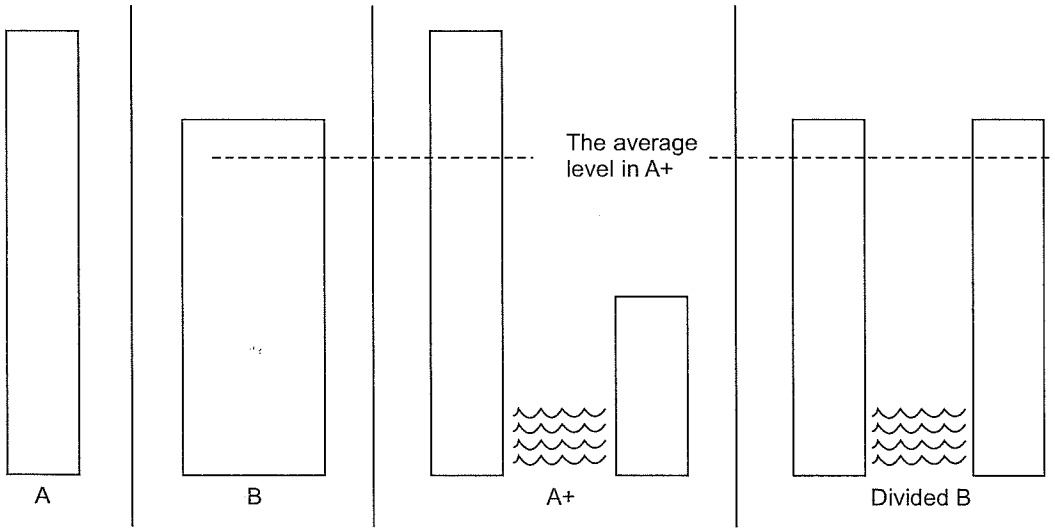

Figure 25.2 Parfit's "Mere-addition paradox."
Source: Derek Parfit, *Reasons and Persons* (Oxford: Oxford University Press, 1984.

The mere-addition paradox

One of the most perplexing of Parfit's paradoxes is the "mere-addition" paradox. (Parfit, 1984, ch. 19) The paradox arises in the comparison of the alternative populations represented in Figure 25.2. The width of the rectangles represents the number of people who exist, while height represents their level of well-being. Parfit stipulates that in A+ and Divided B an uncrossable sea separates two groups, whose numbers and levels of well-being are represented separately. One way to generate the paradox is to compare these alternatives to one another as follows:

1) *B is worse than A.*

Argument: All members of B are worse off than any member of A. Any principle that rejects this claim will imply the repugnant conclusion that for any finite population of very well-off people, there is some larger population of people each of whom has a life barely worth living, such that this larger population is better than the former (Parfit 1984, p. 388). Since we have good reason to reject this repugnant conclusion, we have good reason to accept that B is worse than A.

2) *A+ is not worse than A.*

Argument: The only difference between A and A + is that in A+ there exist more people, all of whom have lives worth living. It is implausible to suppose that the "*mere addition*" of their relatively happy lives constitutes a net loss, or that they make the overall situation worse or less choiceworthy. While there is inequality in A+ that is not in A, this inequality does not reflect injustice, for the two societies in A+ are separate and both redistribution and exploitation are impossible. So the existence of this inequality does not make A + worse than A. But this implies that overall A + is not worse than A.

3) *Divided B is just as good as B.*

Argument: The only difference between Divided B and B is that in Divided B there are two separate communities. Everyone is equally well off, and the number of people is the same. This division is not morally relevant, so Divided B is as good as B.

4) *Divided B is better than A +.*

Argument: In Divided B, the average level of well being is greater than in A+. If we imagine a gradual transition from A+ to Divided B, we see that the gainers have gained more than the losers have lost, while everyone is still adequately provided for. Those who accept a Rawlsian difference principle may note that such a principle would also favor Divided B over A+, since the worst off persons in B are better off than the worst off in A+. Finally, if equality has value, or inequality disvalue, Divided B has more equality, and less inequality than A +.

As long as the "better than" relation follows standard rules of ordering, we should be able to make some inferences from these four propositions. For example:

5) *B is better than A* + (from propositions 3 and 4).

6) *B is not worse than A* (from propositions 5 and 2).

But proposition 6 contradicts proposition 1. Which of the moves above should be rejected? There is no broad agreement about how this question should be answered. Some conclude from this paradox that the "betterness" relation must be intransitive (Temkin 1987). Some urge that we should accept total utilitarianism, or a variant of the total view, and that we should swallow the Repugnant Conclusion (Ng 1989; Broome 1992). Some argue for a negative utilitarian view that focuses on minimization of misery rather than the maximization of well-being (Wolf 1997). None of these solutions is without problems of its own, and none has more than a minority of adherents. The debate on these problems will undoubtably continue among theorists for quite a long time.

Fortunately, these theoretical paradoxes do not pose difficulties for the practical problem of population as a question of social and environmental policy. We are not faced with a choice between a small future population of very well-off persons (like A) and a much larger alternative population of less well-off people (like B). The population effects of policies are only predictable in vague terms, but in the real world we can confidently predict that increasing rates of population growth and fertility will lead to increased poverty, environmental destruction, and human misery. We do not need to solve the paradoxes of population theory before taking what steps we can to avert these consequences. Nor do we need to solve these paradoxes before we can support collaborative policies designed to reduce fertility by improving educational and employment opportunities for women, and by working toward the alleviation of current poverty and social insecurity.

Population ethics and environmental philosophy

Environmental philosophers have not generally devoted great attention to the growth of human population, but it is clear that population growth is one of the most important environmental problems of our time. Unless human population growth can be slowed and stabilized, it is unlikely that efforts to reduce the rate of environmental destruction can be successful. Many environmentalists naively accept the Malthusian argument that human development will simply provide grist for human population explosions in poor, environmentally stressed parts of the world. Some feed the misanthropic image of environmentalists by proposing that we should control the population problem by letting people starve. But if the best way to reduce fertility is to encourage human development in poor countries, then this Malthusian strategy is unlikely to achieve the desired aims. This is an important and hopeful implication for several reasons: first, it implies that the best way to address the population problem is to pursue social goals such as human development and women's equality. These are goals that we already have sufficient independent reason to support. Second, it implies that environmentalists must also be concerned with issues of social justice and human development. If it is true that the growth of human population is among the greatest of all threats to the world's ecosystems, and that this problem can most

effectively be addressed by policies that work toward human development and social justice, then environmentalists must focus on social justice if we hope to preserve the fragile natural systems of the earth (see ENVIRONMENTAL JUSTICE).

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