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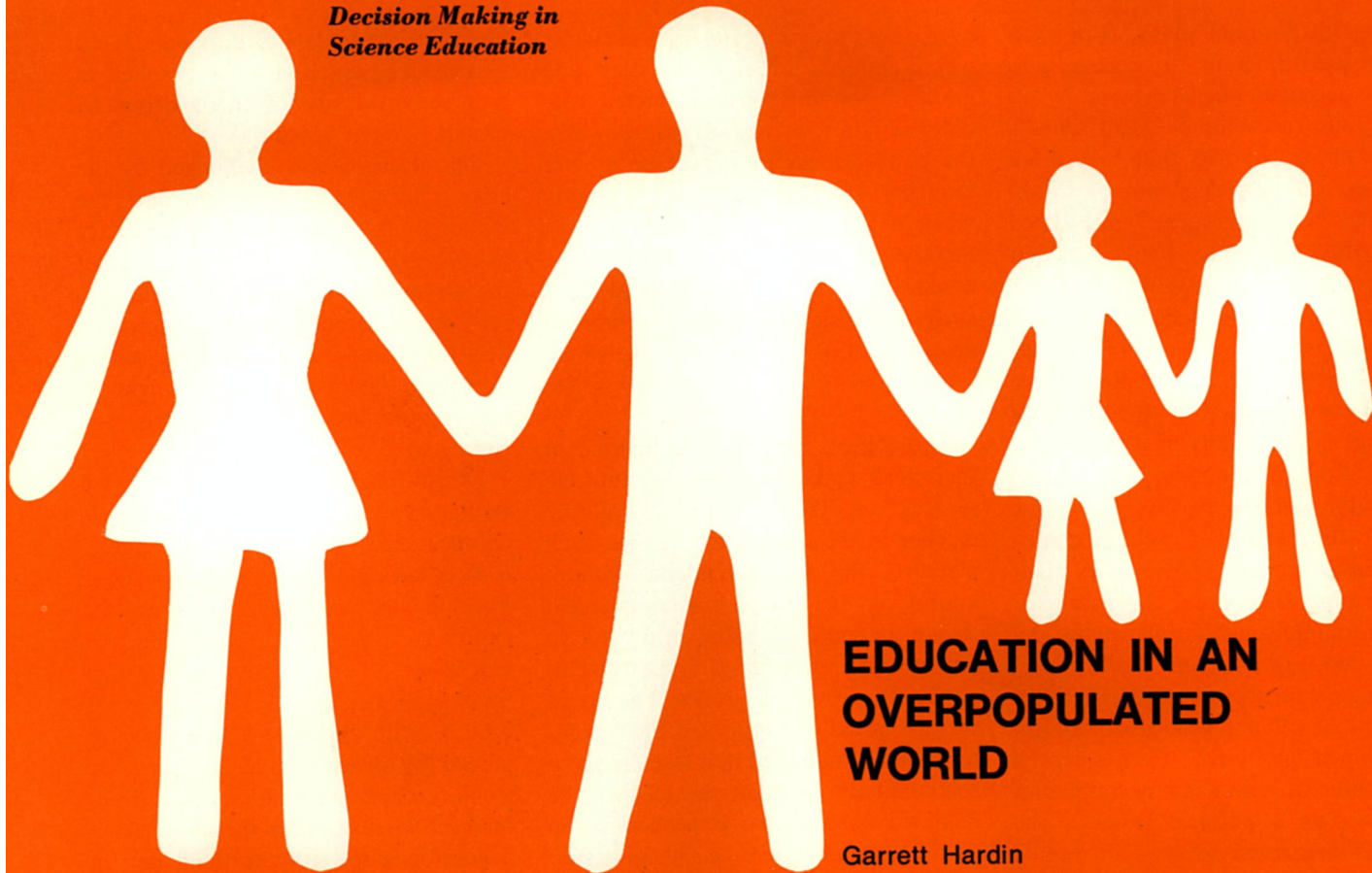
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EDUCATION IN AN OVERPOPULATED WORLD

Garrett Hardin

HOWEVER much we may complain about the profession of education these days, we certainly cannot complain that it is dull! Teaching can still be *made* dull, of course; but censorious students will soon disturb the equanimity of any instructor who closes his mind to "relevance."

It was not always so. There was a time when most scholarly activity, including science, was a genuine refuge from the troubles of the world. This happy state of affairs was hauntingly described by Albert Einstein a long generation ago:

Man tries to make for himself in the way that suits him best a simplified and intelligible picture of the world and thus to overcome the world of experience, for which he tries to some extent to substitute this cosmos of his. This is what the painter, the poet, the speculative philosopher and the natural scientist do, each in his own fashion. He makes this cosmos and its construction

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the pivot of his emotional life, in order to find in this way the peace and security which he cannot find in the narrow whirlpool of personal experience. [1]

"Peace and security"—it is difficult not to feel a twinge of nostalgia as these words ring in our ears. There is little peace in Academia these days; and no security save that which we earn by a vigorous defense of rationality and a willingness to give up any particular items of belief that prove wanting in the face of critical questioning. Peace is not for our generation, but we can survive. More than that, we can change the world—and it is change that is demanded once we ask, "What is the relevance of our specialized knowledge to the pressing human problems of the day?" The ivory tower is gone, and we have become agents of change.

Nowhere is fundamental reform more necessary than it is in the area of population. The development of death control in the last five generations has made attitudes that were adaptive for three thousand genera-

tions now maladaptive. Now—and *from here on out*. The seemingly boundless frontier is gone, and suddenly we realize we are crammed into a spaceship. With a diameter of almost eight thousand miles our ship is somewhat larger than an Apollo craft that holds three men, but in principle it is no different. In the face of the explosive power of exponential growth what difference does it make whether the diameter of the space craft is 20 feet or 21 million? Very little. In either case it is finite. It is not expanding. It can hold only so many people. The inhabitants of a spaceship are surrounded by an effluvium of their own waste products. Recycling is a necessity. Above a certain level of population—which we no doubt passed some time ago—the greater the population, the worse the environment in the spaceship. [3] If we want to live in dignity, we must find a way to limit the number of passengers on our fragile craft.

At the moment we are completely failing in this task. Fourteen years ago

the population of the world was increasing by 123,000 *a day*. [9] Now the increase is 190,000 per day. Next year it will be greater.

Think of it: an increase of 190,000 per day. That's 2.2 more persons alive every second. Each time you take a breath 13 more people are stressing the inadequate resources of our little craft.

That's no way to treat a spaceship.

WHAT are we to do? Whenever we human beings are faced with a hard decision, our first impulse is to run away. Population control is a hard decision. True to form, we try to run away from the problem of controlling population. Some of us say that we don't need to worry about the finiteness of the earth because we can always ship our excess population off to other planets.

Unfortunately not one of the other planets of our solar system is anywhere near as suitable to human existence as is Antarctica or the top of Mt. McKinley—and there's no sign of a real estate boom in either of those two desolate places. Denied escape to the planets of our own sun, we find the next *possible* refuge to be at least 4.3 light-years away—that's 25 trillion miles. The triple sun Alpha Centauri *might* have some planets suitable for human life. Again, it might not.

Consider the expense of such a migration out into space. A number of years ago I calculated roughly the cost of shipping people off in a suitable spaceship, minimizing costs outrageously to give the opposing view every possible advantage. [4] It came to \$3,000,000 per earthly emigrant.

To keep the earth's population from increasing beyond its present level you would have to ship off 190,000 people every day. That would cost 570 trillion dollars *per day*. The GNP of the United States still has not reached the level of one trillion dollars *per year*.

Well, it was a good try.

SO space is no escape. What next? The next evasion is birth control. Does that statement surprise you? If it does it is because you equate birth

control with population control. This equation is part of the "conventional wisdom," to use Galbraith's term [2], the wisdom that is almost right but not quite. Ninety-nine people out of a hundred think birth control *is* population control. Ninety-nine people out of a hundred are wrong.

It takes a hammer to build a house, but who would equate a carpenter's tools with architecture? Similarly, birth control is merely a tool with which population control *may* be achieved—but again it may not. It depends on what you use the tool for.

A simple systems analysis of the population problem will help make this clear. The principal actor (or rather actress) in the drama is the woman. It is she who produces the children. Men are needed too, of course, but they are so ubiquitous and so readily available that it is safe to think of spermatozoa the way we think of air and water—as nearly always available, and virtually free. Systematic analysis is best focused on the woman; she is the most powerful agent in population production.

The birth-producing system can be decomposed into elements of Message, Reception, Performance, and Results (see Table 1). The target of the system, the woman, receives many messages—from her parents, from her friends, from her religion, and from society at large. Let's see what some of these messages are, taking them one at a time, and deducing their population consequences. To begin with we will assume that the reception of the messages by the woman is perfect and that she uses a perfect system of birth control.

One message the woman might receive is "Stop at two," which is the

message of the ZPG people (Zero Population Growth). If all women received and acted on this message a stable population would ultimately result, because the amount of increase is zero. (In our rough analysis we ignore minor effects like celibacy and sterility on the one hand, and multiple births from second pregnancies on the other. Perhaps these would balance out.)

Suppose the only message a woman received was "A boy for you, a girl for me,"—which you may recognize as from the musical comedy, *No, No, Nanette*—what would be the population consequences of this? If she and her husband decide they won't stop breeding until they have produced one of each, how big will their family be? Probability enters at this point; it turns out that the average family will have approximately three children in it. The population will increase 50 percent each generation. (The U.S. population is increasing not quite so fast as this now.)

Let's try another message. Talking with many educated people in India recently I became convinced that the message most commonly heard by an Indian woman is this: "An heir and a spare." Immersed in the Indian culture, it seems essential to her that she have at least one son; and prudence dictates two, because one may be lost to disease. Given the directive to keep producing until she has two sons, a woman will produce on the average approximately four children. India's present population growth rate—2.5 percent per year—is about what you would expect from adherence to such an ideal, assuming most of the children are produced early in a woman's breeding years.

In the light of these mathematical

Table 1. A systems analysis of population growth.

MESSAGE	RECEPTION	PERFORMANCE	RESULT	INCREASE
		Effectiveness of Birth Control Assumed	Approximate Average Number of Children per Family	Factor of Increase per Generation
Society's Directives, Implicit or Explicit	Precision Assumed			
"Stop at Two"	Perfect	Perfect	2	1 (ZPG)
"A boy for you, a girl for me"	Perfect	Perfect	3	1.5
"An heir and a spare"	Perfect	Perfect	4	2

relations let's ask, "What is the population problem?" Conventional wisdom thoughtlessly presumes that all we need to solve overpopulation is birth control. "If only we had a better method of birth control," people say, "we could bring population growth to a halt." But the results indicated in Table 1 assume a *perfect* method of birth control—only the first message produces ZPG. Neither of the other messages does, and these messages circulate widely throughout the world. These messages are received and acted upon. The message "Stop at two" is still very uncommon among the world's 3.7 billion inhabitants.

Let's look at the matter another way. Suppose the commonest message in a society is the second one, "A boy for you, a girl for me." With a perfect system of birth control, three-child families would be the average. Such a perfect system is within our reach in the United States: the perfect system consists of contraception, plus abortion as a back-up for contraceptive failures, to be followed by sterilization after the reproductive goal has been reached.

But some Americans are reluctant to employ abortion and sterilization. The reluctant fraction of the population is rapidly diminishing, but let's put that fact aside for the moment. Suppose abortion and sterilization are rejected and only the best method of contraception is used: How serious would its imperfection be?

HOW reliable is the contraceptive pill? Christopher Tietze [10], the leading authority in this matter, says that it has an intrinsic failure rate of only 0.1 pregnancy per hundred woman-years of exposure to the risk of pregnancy. Much higher failure rates than that are probably due to "forgetting," to a woman's ambivalence about taking the pill. In such cases, it is not the Performance of the technology that is at fault, but the Reception of the message. Since I am concerned here only with the consequences of Performance errors, I will take 0.1 percent per year to be the intrinsic failure rate of the contraceptive pill.

Suppose a woman elects to have

three children, and relies entirely on the pill for birth control: How many children will she probably have? Method failures *before* she achieves her goal produce only failures in spacing, not in number; so let's focus only on method failures taking place *after* she has achieved her goal of three and see what the populational consequences will be.

Assuming she has the desired three children by the time she is 25 years old, she now has 20 years of risk ahead of her. If she uses the pill, and if we assume the risk rate is 0.1 percent per year, she will (statistically speaking) produce 0.02 of a child more than she wants in her remaining fertile years. Following the directive, "A boy for you, a girl for me," and using a birth control method that is 99.9 percent perfect, women will produce an average of 3.02 children each, instead of an average of 3, as they would if they used a perfect method.

But the number desired (3.0) is much greater than the number needed for ZPG. Because of mortality, celibacy, sterility, etc., the true ZPG number is not (contrary to Table 1) 2.0 per woman, but closer to 2.11 per woman in the U.S. Women who produced 3.02 children would exceed the ZPG number by 0.91 child. To what should we attribute the excess over the ZPG number?

The excess can be divided into two portions:

- a. excess due to error of method = $.02 \div .91 = 2\%$ of excess
- b. excess due to error of goal = $.89 \div .91 = 98\%$ of excess

Now we see why fretting about the technology of birth control is a way of running away from the population problem. A birth control method that is 99.9 percent reliable is really good enough. Why knock ourselves out to improve it? If too many babies are being produced it is because the method is not being used, whether out of ignorance, fear, or prejudice; or because individual women want more babies than are needed on a spaceship. In any case, the problem of population control is not a technological problem, not in the ordinary sense. It is a prob-

lem deep in the minds of women and men.

WE run away from hard problems—and try to hide our cowardice from ourselves. Let me illustrate this point. At the end of 1970 the Department of Health, Education, and Welfare put out a little booklet entitled "The Federal Program in Population Research." [11] It claims that the total funds allocated to population research in 1970 amounted to 163 million dollars. Sounds fine. At last it sounds as though we're doing something about population. But are we?

Burrowing around in the tables, one finds that 80 percent of those millions went for "Data Generation and Compilation Activities." What does that mean? Well, 96 percent of *that* money went to the Department of Commerce, and you know what it was used for: the Bureau of the Census. Is that population research? If putting out a telephone book is carrying on research in information theory, then census-taking is population research. That's stretching the meaning of population research too far. But it looks nice in a government report.

What about the remaining 20 percent, 34 million dollars, which might classify as population research? It's risky trying to deduce the contents of research programs from their titles, but perhaps we can reach a first approximation to the truth. Looking over the printed titles, I estimate the projects can be assigned to the categories shown in Table 2. Out of every thousand dollars spent for population research, only about two dollars seem to be aimed at altering the population message or improving the reception of it. Perhaps as much as 110 dollars—certainly no more. The rest is spent on trying to improve the performance of already excellent methods of birth control.

Table 3 puts the matter more bluntly. We spend 89 percent of our money to tackle only 2 percent of the population problem; by contrast, to 98 percent of the problem, we allocate at most 11 percent of the money, and maybe as little as 0.2 percent.

We've got our priorities mixed up. We had better stop running away from the problem.

SUPPOSE we do stop running, what then? What can we do? I don't know; I don't think anybody knows for sure. But I think we must make a beginning with the Message.

Some of the messages children are getting are utterly unsuitable for people living on a spaceship. Among contemporary children's books I know of no more sinister example than one called *Always Room for One More*. [7] The writing and the art work are of the highest quality, but the message is vicious. Don't worry, it preaches, we always have room for another person; isn't this crowding jolly? . . . This benighted book was published in 1965, four years after Yuri Gagarin became the first traveller in a man-made spaceship. The author had apparently not yet caught the insight into human problems generated by the space effort.

I don't know how many children have read this immoral book; not many, I hope. But millions have read the lower-key Dick and Jane books. Remember them? They had a population message in them too, though I'm sure the authors were unaware of this fact. The neighbors on the left had children; the neighbors on the right had children; the ones across the street . . . in fact, all God's chillun had chillun. Nothing else was conceivable. Exposed at a tender age to such a message, what is a little girl to conclude?

Plainly that she just has to become a mommy when she grows up. Nothing else is normal. That's the message of the Dick and Jane books.

I think it's time to change the message. I have suggested [5] that we augment that message with another one, a contradictory one. Let us introduce the first-graders to delightful Aunt Debbie—forty years old, pretty as a picture, fond of men, and fond of children (but only in small doses). She is a working woman and likes her job. She likes her freedom. The children just love her and look forward to her visits.

Jane, in the depths of her subconscious, wonders whether she wants to be like Mommy when she grows up, or like Aunt Debbie. She doesn't know. She just doesn't know.

And she shouldn't, not at her age. Let Jane grow up hearing *two* messages: being a Mommy is nice—but so is being a Debbie. Let her find her own identity. Later. And let society make it possible for her to live a psychologically rich and respected life if she decides that parenthood is not for her. We will all benefit if women are freed to find their own identities and not pressured into having children needed neither by them nor by society.

The major population problem immediately ahead of us is educational, not technological. In the elementary grades we must keep the option of childlessness alive in the child's mind. At the secondary level we must display a wide spectrum of enticing vocations

available to nonparents. A significant part of our success in population control will come as a "fall-out" from persuading *and making it possible* for more women to become scientists, artists, machinists, business women—the list is endless. It even includes work in the nursery—the community nursery, that is—as professionals in child care. We not only have too many children, we have too many poorly taken care of. We need to *pay* women to fulfill this role, so important to the nation, instead of expecting them to be unpaid slaves. Paradoxical as it may seem, if we pay them well for taking care of children they will probably breed less.

We live on a spaceship. There are too many of us. Some of the decisions we will ultimately have to face [6] may require a long political reorientation first. [8] But it is possible even now to begin on the challenging task of educating our children so that our grandchildren will live in a spaceship less crowded than ours, and live a better life. Let's get at it. □

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Table 2. Allocation of federal funds for population research in 1970.

CATEGORY	PERCENT OF FUNDS
Performance research (birth control, delivery of services)	88.9
Uncertain classification (academic sociology)	10.9
Message and Reception research, apparently	0.2
	100

Table 3. Allocation of federal funds nearly irrelevant to population research needs.

	MESSAGE AND RECEPTION AREAS	PERFORMANCE AREA
Distribution of the money	0.2% - 11%	89%
Distribution of the problem	98%	2%