

A WORLD FULL OF PEOPLE

THE FACTS OF POPULATION

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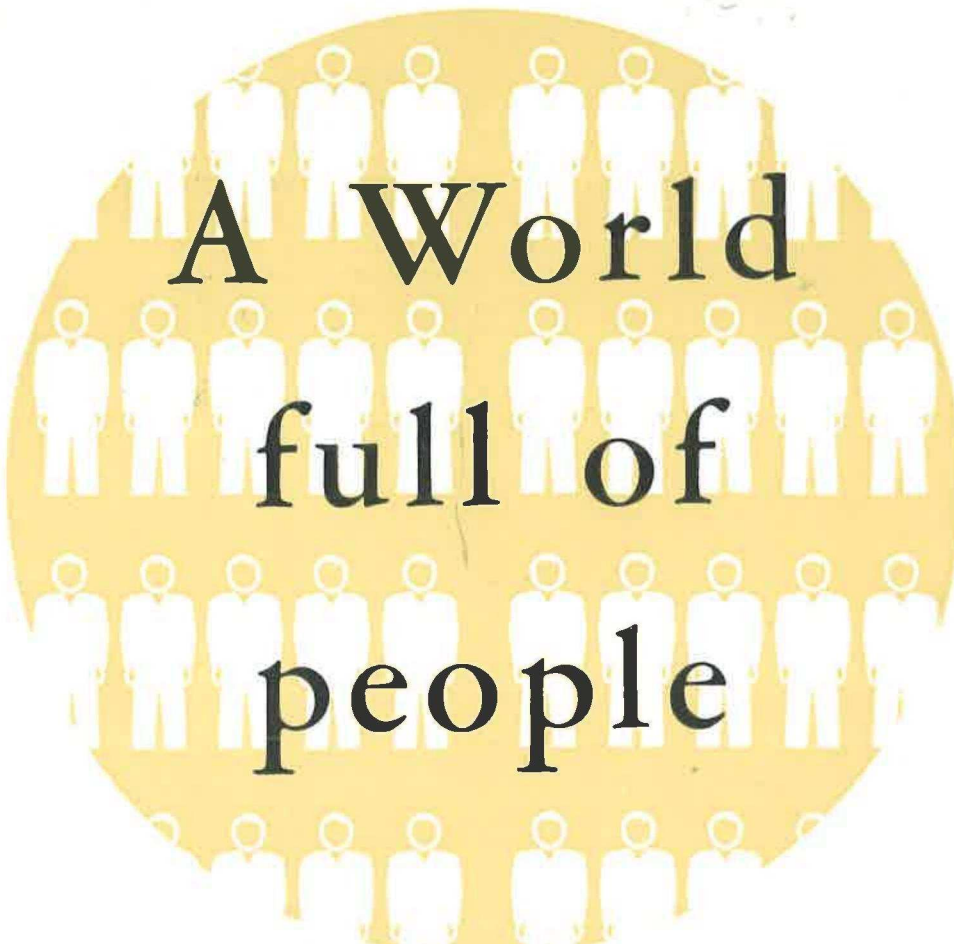
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A World full of people

For who can count the multitude of men?
They are like grains of sand,
And who can know their diverse nature
and condition,
From the most base to the most exalted?

PEOPLE are the most valuable of natural resources—and the most universal. Perhaps this very ubiquity, together with mankind's propensity to replenish itself with little or no encouragement, accounts for the tendency in many quarters to take population for granted. Indeed, it is probably fair to say that the existence of any problem in this connection would have seemed novel a few centuries ago. If any problem existed then, it was apt to be merely one of stemming the flood of mankind that threatened the available means of subsistence.

We have, however, become aware in recent times that there is more to population than its mere size or its growth, important as these are in a national economy. Population, we now recognize, has a complex structure, with a dynamic balance between the component elements. Alterations in one of these elements, can lead to significant changes in the whole. But more than these quantitative aspects of numbers and rates, population has

a qualitative side. Two populations of equal size and of similar age structure may yet be vastly different in biological fitness. This is a phase of population much less known or understood, but obviously one of the utmost importance. To study the behavior of aggregates of people, how they maintain their size, why they increase or decline; to analyze such aggregates into their significant elements and to determine their mutual adjustments; to ascertain if such aggregates are improving or degenerating in quality—these are the aims of the biology of population. It is a subject of the greatest practicality for the welfare of a nation.

A population is the total number of individuals who may be embraced

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By HARRY L. SHAPIRO*

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The facts of population are vital to every nation and to the international adjustments of the world. Here the basic principles and their significance are discussed in non-technical language

within a given classification. Thus we may speak of a school population, the population of New York City, the male population, or the population of the United States. Statistically considered, these populations may be described by various mathematical devices, and, when chronology or comparison with similar groups is added, we may deduce from such mathematical summations certain trends and tendencies. Because all the units or subdivisions of a nation are influenced far more by each other than any one is by similar units in other nations; because intermixture is more common within national boundaries than across them; because the national destiny combines all the subdivisions into a kind of biological as well as cultural, political or economic entity, we have come to think of the total national population as a biological expression susceptible to scientific study and analysis.

I have frequently speculated a little on the origin and evolution of our

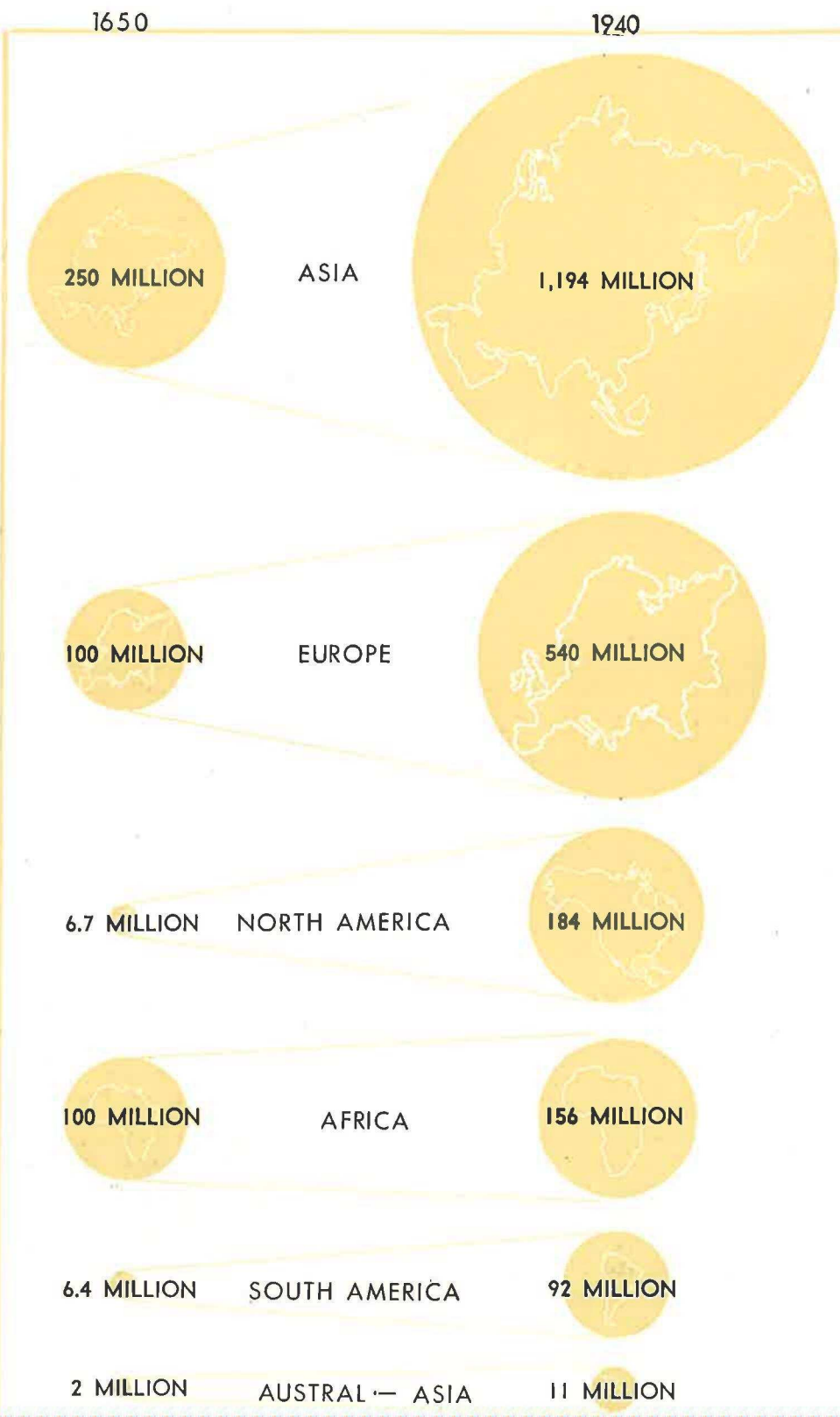
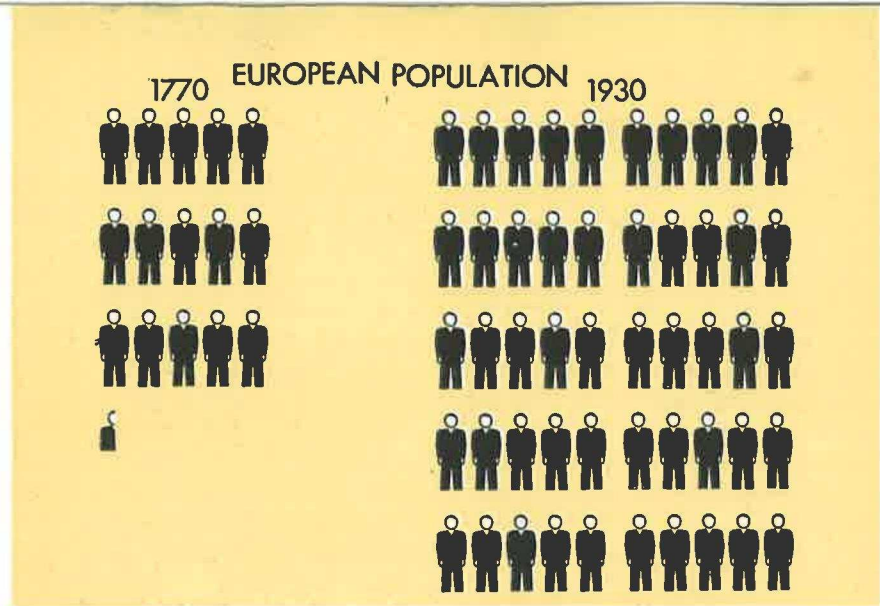
mixture, population, etc. His publications include *Heritage of the Bounty, Migration and Environment*, and numerous articles and papers, both scientific and popular. He is active in several scientific societies.

Since 1942 Dr. Shapiro has been Chairman of the Department of Anthropology of the American Museum, where he has worked since 1926. He is also Professor of Anthropology at Columbia University and Associate on the Staff of the Bishop Museum in Honolulu.—ED.

➤ **RAPID GROWTH** of population due to industrial development, lowered death rate, and the development of resources in the New World

interest in the biology of population, and it seems to me that much of it has been stimulated by the accumulation of data provided by the census. Before the notion of census taking became an established function of national governments, little if any attention was directed toward the study of population as population. What enumerations were in existence were outgrowths of other concerns. Tax lists had to be drawn up, or man power resources for military uses had to be mapped. Enumerations of people also had value for the church and were significant for various political and economic purposes. But these counts were never primarily instituted for biological reasons and were rarely employed for such ends. Although they go far back in recorded history, they were with few exceptions, desultory and unsystematic. Not until fairly recent times did the notion become established that periodic and systematic enumerations of the population are valuable and necessary enough to warrant their being a fixed function of the government. The earliest official census, as distinct from estimates, seems to have been initiated in New France in North America and was continued there from 1665 to 1754. The United States was among the first of modern nations to establish, in 1790, a regular census repeated at fixed intervals. Its purpose was primarily political, since it was designed to serve as a basis for representation in Congress. Great Britain began periodic enumerations in 1801; and by the end of the nineteenth century, the economic and political necessity of census taking was recognized in most civilized countries in the world. The necessary organization, however, for an accurate census in a large country still proves a stumbling block for many governments, with the result that even official national censuses vary widely in their reliability from country to country. But whatever the origin of the census

➤ **GROWTH OF POPULATION BY CONTINENTS.** Note that the increase has been much greater in some continents than in others and that the distribution of population throughout the world is quite different than it was a few centuries ago



may have been—political, economic or military,—the study of population problems proved to be one of its unforeseen and most valuable by-products.

Since the first censuses provided little more than total counts, the pioneer students were restricted, by the very data available, to the problem of the total growth of national populations. It happened, however, that the trends revealed by these initial enumerations were startling enough to warrant serious thought. As early as 1755 Benjamin Franklin was commenting that the population of the United States was doubling every 25 years, and by the end of the eighteenth century Malthus already had enough available data to be impressed by the dangers of a population growing beyond its means of subsistence. How rapidly various European nations were growing may be seen by comparing Europe's population in 1770 and 1930. In 1770 it was 152,500,000; 160 years later it had increased to about 500,000,000—something like 3 times. This remarkable expansion seems to have begun in Western Europe and to have gradually spread throughout the continent. In America the rate of growth was

even more rapid than this, as it also was in the British colonies in New Zealand and Australia.

The phenomenon was so widespread and so decisive that at first expansion was assumed to be the natural condition of all populations, and alarm was frequently expressed for a future in which a world bursting with people would find its means of subsistence inadequate to support them. We now know that this increase was merely one phase of the world's population history and that expansions on this scale had never occurred before. Indeed, a little arithmetic demonstrates how unlikely it is that populations in the past have grown at a rate anywhere near their full reproductive possibilities. If, for example, reproduction were uncontrolled, a woman could give birth to 5 or 6 children between her 17th and 27th year. If 4 of the children survived and reproduced in their turn at the same rate, the population would double every 27 years. But this is not the highest rate possible by any means. If a woman survived to her 35th year, she could easily bear 8 or 9 children. With only 6 offspring surviving, the population would triple every 35 years. Thus a single couple

reproducing at the first rate would yield in 540 years, 2,097,000 descendants, and at the second 45,956,000. In 1080 years the respective number of descendants from one husband and wife would reach 2199 billion and 1,656,000 billion. Obviously, then, mankind has not been increasing at anywhere near its full potential. And the acceleration in recent centuries cannot have been going on for very long. If we project backward the modern population of Europe, reducing it by the same rate that it has increased over the past 160 years, we would find ourselves in an empty Europe at the beginning of the Christian era.

When we recall that man is estimated to have an antiquity of about one million years, it is obvious that he has neither increased steadily nor at his full capacity. Over much of this period the human population must have remained static or even retrogressed. Although statistical evidence of this nature does not exist for mankind's early history, we have some fragmentary evidence to prove that populations are not forever expanding.

Japan, for instance, had a population of 28.1 millions in 1721, and 135 years later her population was roughly the same (28.9 millions). Spain, in the seventeenth century, had passed beyond one growth phase and was in a state of decline, a circumstance rarely mentioned in connection with her political decline and her colonial policies.

Why is it then that populations increase, decrease, or remain static? There are various reasons given, but let us first examine the direct mechanism by which the process itself is controlled. There are four functions whose mutual adjustments determine the curve of a population. These are birth rate, death rate, immigration, and emigration. By the rates of these and by these alone is the size of a population determined. The differential between birth rate and death rate

if

one husband and wife had six children and each pair of children had six children, they could populate the entire world in 19 generations



One Husband and Wife

FOURTH GENERATION
162 persons, comparable to



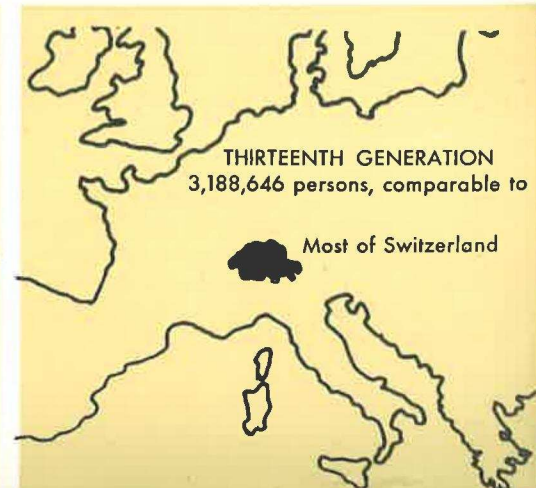
All the Delegates to the League of Nations

ELEVENTH GENERATION
354,294 persons, comparable to



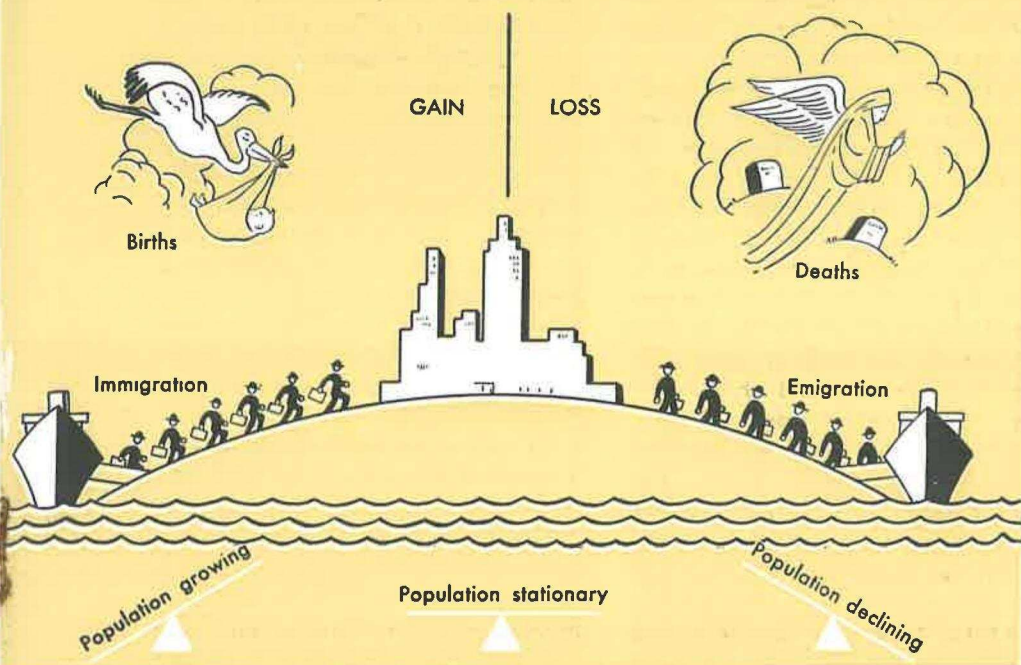
The City of Zurich

THIRTEENTH GENERATION
3,188,646 persons, comparable to



Most of Switzerland

FOUR FACTORS DETERMINE POPULATION GROWTH OR DECLINE



gives us the natural increase or decrease—the amount by which a population, by the success or failure of its own efforts, is adding to its numbers or losing them. Ordinarily birth rate and death rate alone are the decisive factors, but under certain circumstances the displacement of population from one country to another may strengthen the national trend of a population or counteract it. Immigration to the United States during most of its history was a significantly positive contribution to its remarkable growth. Ireland during the famine years was unable to replace by its own natural increase the losses suffered by emigration. France in recent years has sought to redress her unfavorable balance between births and deaths by permitting the immigration of Italians and Poles. But in most countries, and during most of the time, the balance of births and deaths determines the issue.

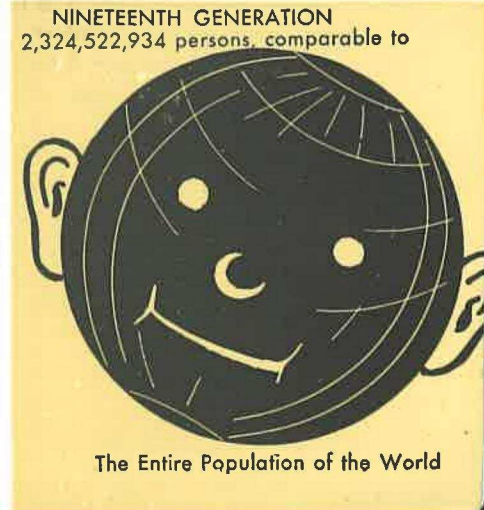
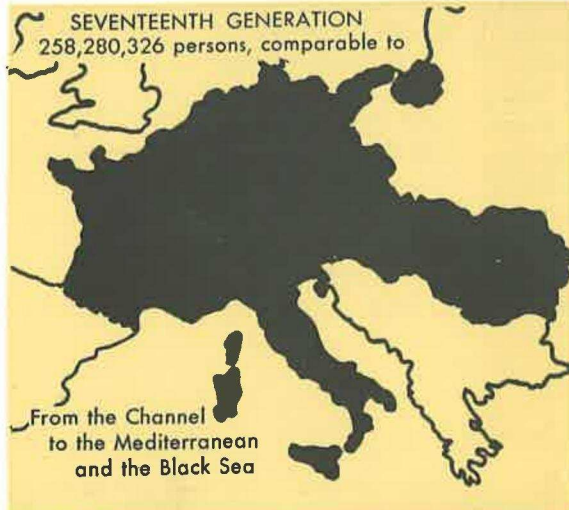
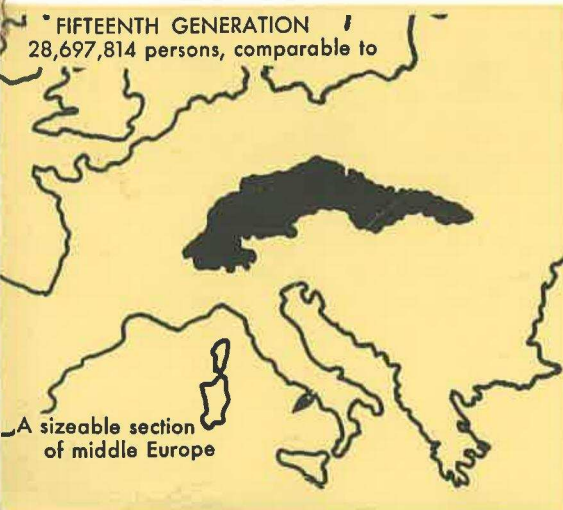
Natural increase is achieved when the birth rate surpasses the death rate, and the greater the difference the larger the increase. But birth rate

need not be increased to attain this favorable balance, it may be accomplished by a decline in the death rate. Where both rates are changing the natural increase will be proportional to the relationship between them. During the past century the birth rate of western Europe was dropping steadily, but the natural increase was maintained because the death rate was also dropping and in some cases more rapidly than the birth rate. Since the drop in death rate has slowed down and the drop in the birth rate threatens to approach it, the natural increase is shrinking away. It is apparent, therefore, that an explanation of why populations increase or decrease must be based on the factors that govern not only the birth rate but also the death rate and the balance between the two.

Among the variables that one might expect to be most effective in determining differences in birth rate is innate fertility. We are so accustomed to having the high birth rates of the Japanese or the Russians or the Southeast Europeans contrasted with the

dwindling families of the French, English, and Americans that almost insensibly we come to assume a difference in fertility. Similarly we are apt to attribute a greater power of reproduction to primitive people than to the highly civilized. Some authorities, however, deny that any real distinctions can be drawn between the various races or peoples of the earth in this respect. They maintain that unhampered reproductive rates are approximately the same for all mankind, somewhere between 40 and 50 per thousand, and that whatever deviations occur are attributable to inhibiting factors. For all practical purposes, according to this view, we may neglect any possible variation in innate fertility and speak only of limiting circumstances. The following chart, based on figures published by Raymond Pearl, supports this contention, but it should be stressed that the available data are by no means adequate for a universal generalization. Sterility, however, in so far as it lowers the average fertility of a population does seem to occur more frequently in highly civilized societies than in primitive ones.

Leaving aside therefore the question of any inherent differences in reproductive powers, there are two principal sets of limiting influences on birth rates. One is social and long term, the other is catastrophic and short-lived. A study of primitive as well as civilized sex customs reveals a diversified series of habits and rites that limit in varying degree the natural fertility. Sexual taboos of diverse descriptions, for example, are commonly practiced among primitive people. Sexual intercourse may be forbidden before ceremonial occasions, before battle, for ritual reasons, and for varying periods in connection with menstruation. In extreme forms, a woman may actually be excluded from the possibility of reproduction during half her child-bearing period. The custom among certain primitive



women of nursing children for an extended time tends to reduce the chances of conception, and in fact the practice is deliberate with many of them who desire to keep their offspring at a minimum. It has been reported that some primitive groups who cultivate this device keep their children down to 4 or 5 per woman.

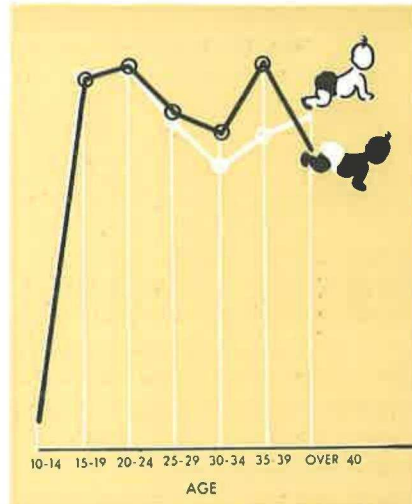
Abortion is by no means universally accepted, of course, as a method of birth control; nevertheless it is commonly practiced in many societies, our own not excepted. How effective or how extensive a method it is we do not know, since accurate information is lacking. Certainly in most primitive societies knowledge of it is widely disseminated, and inquiry readily elicits specific details of procedure as though recourse to it were frequent enough. Estimates for a city such as New York run into colossal figures. One estimate suggests that as many conceptions terminate in abortions as in live births. There can be little doubt that this method of limiting births is one of the most significant in human history.

Another method of reducing the population if not the actual birth rate is by infanticide. This resource is to our minds a revolting practice, yet in certain countries it has been adopted and has received social approval or at least tacit tolerance. It is apt to occur where the pressure of population has become a serious problem. In Tahiti, for example, Captain Cook found the natives openly abandoning female children to exposure and death. The teeming population confined within its narrow island presumably could not expand further and the excess had to perish. Those who doubt Malthus have here an object lesson on the reality of population pressure. China, too, has countenanced female infanticide, and in times of stress its practice increases. So common a thing is it in China that its profound results may be read in the marked excess of males over females ranging from 10% to 50%.

Less direct than these is the effect of various other by-products of social custom. Among them I might mention the increasing age at marriage which, at least until very recently, was evident in highly civilized societies. Economic causes are generally assigned to the tendency to delay marriage among us, but in at least one primitive group with which I am familiar this delay arises from a

gerontocracy where the old men are dominant and pre-empt most of the young maidens for themselves, leaving the young men to make the best they can of the old ones or wait for their turn with advancing years. The tendency to delay marriage, other things being equal, results in smaller families.

Concubinage, which one might expect to enhance the birth rate, is said on the contrary, to depress it, since



After Raymond Pearl

▲ THE FERTILITY OF NEGRO AND WHITE WOMEN appears to be similar. The chart shows mean pregnancy per 100 ovulations in women who married only once, had no gynecological disease, and did not use contraceptives

a large number of women are removed from the full exercise of their reproductive possibilities. Women under this system are individually unlikely to have as many children as they would if married to one man, in spite of the impressive totals of offspring that a sole male under such a system may pile up. Similarly large scale prostitution has the same consequences but for a different reason or reasons, one of which is the prevalence of social diseases among the practitioners of this profession. But social disease apart from its existence among prostitutes is also a very significant factor in reducing the birth rate in the general population. This alone was responsible in large measure for the rapid depopulation suffered by Polynesia in the nineteenth century. Let me cite a single instance. The Marquesans at the time of Cook's visit toward the end of the eighteenth century, possessed a population estimated at around 100,000. In 1920 there

were about 1600 natives left—less than 1/50th. A survey I made there ten years ago, disclosed a large number of sterile marriages and a high prevalence of miscarriages. Gonorrhoea and syphilis were rife. The prospects looked very bleak indeed that this handful of once magnificent Polynesians could long survive. About 15 years ago, however, one of the government physicians began to combat social diseases in a few localities, and in a relatively short time the birth records began to show a remarkable increase. For the first time in over a century a favorable balance was established precisely in the localities where modern medical treatment had been administered.

It has frequently been suggested that urbanization, with its attendant nervous tensions, may be one of the causes of sterility and reduced reproductive capacity. If it is, we cannot assess its role in the complex of factors which are operating toward this result. One of New York's most distinguished gynecologists once told me that he was able in a fair proportion of sterility cases to achieve cures by prescribing rest and travel.

Perhaps the most effective curb on the birth rate is the various techniques of contraception. The idea of contraception is a very old one. It was known in antiquity. But only in recent times has its practice become almost universal in some countries and in certain classes in most civilized societies. Probably no other single factor has been so effective in cutting down the birth rate. Certainly the present drop in birth rate coincides with the adoption of contraception, and this rate is lowest where contraception is most widely used and highest where it is unknown.

In the long run, the catastrophic checks on birth rate are less potent than those already mentioned. Their immediate influence may be more drastic, but, unless a population is already in decay or sharply reduced in number, recovery from them is fairly rapid. Thus famine, which has swept over China and India repeatedly, carrying off millions to death and cutting back sharply the birth rate, seems to have affected but little the general reproductive rate. It has been calculated that between 108 B.C. and 1911 A.D. China was subjected to 1828 famines, or almost one a year. Britain between 10 A.D. and 1846 suffered 201 famines, or 1 every 9

Population in Millions

tr
sl
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14
sc

All

years. India endured 34 between 1769 and 1878, or 1 every 3 years. While these disasters may temporarily reduce the birth rate, they seem to have no permanent or long enduring consequences on reproductive tendencies. In other words the recuperative ability of a population soon makes up losses suffered from such causes when the short-lived cause itself is removed. Long continued war may also exercise a depressing effect on the birth rate. There has frequently been observed a sharp but temporary rise in birth rate at the initial stages of warfare, but this spurt declines into a lag as war continues, and its consequences extend into the post-war period. In the present conflict, the magnitude of the dislocations are beyond our experience, and it would be hazardous to base predictions on the past. After the last war, however, birth rates adjusted themselves fairly rapidly to the pre-war positions and continued their evolution from that point.

The other component in the equation of natural increase is the death

rise of a population than fluctuations in the birth rate. Conversely, the amelioration of living conditions, improvement in public health, and advances in medical care permit a rapid increase in population by reducing the death rates. The phenomenal expansion of the population of Europe and, indeed, of the world during the nineteenth century may in large part be attributed to these factors. Only as the birth rate begins to follow suit and to overtake the decline in death rate is a static or declining population once more established. This has already happened in France. It seems about to happen in England and the United States.

The extraordinary growth which the populations of the world have undergone in the past century or more has stimulated a good deal of speculation on the nature of the phenomenon. Raymond Pearl has reduced it to an equation and has generalized it to the form of a sigmoid or S-shaped curve. Such curves begin by rising slowly, reach their steepest slope at the middle of their spans and then decelerate gradually. Their application to populations is based on the thesis that a population becomes static when it has reached the limit of the current means of subsistence. When these sources of subsistence are increased, growth takes place. But the new spurt is proportional to (a) the absolute amount of growth already achieved and (b) the amount of unutilized or unexhausted means of subsistence. Such curves fit quite well the history of modern populations and have served many students in their predictions on the future size of existing aggregates.

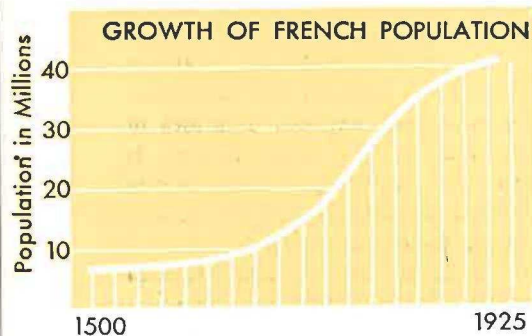
But to describe the phenomenon does not explain it. Corrado Gini has a somewhat anthropomorphic explanation. He considers a population to be something like an organism—that it has a youth, a middle, and an old age. During its vigorous youth it grows rapidly. Then as increasing age makes itself felt, it begins to lose its reproductive force and becomes static or even declines. It would be difficult on this basis to explain the vigor in the ancient loins of China and Italy.

Warren S. Thompson, on the other hand, stresses the importance of environment, by which, I take it, he means agricultural and technological improvements. Looking at the full sweep of man's history, we do see definite increases in the density

of population when new procedures or inventions permit the support of larger numbers. Hunting or food-gathering societies are not usually able to maintain a population as large as an agricultural community in the same area. In aboriginal America, the largest concentrations existed precisely where settled agriculture was well organized. Cities and large populations in the Old World first appeared in the rich valleys of the Nile, the Tigris, the Euphrates, and the Indus, where agriculture received its initial development. The remarkable expansion of population that is so striking in recent centuries coincides with the advent of industrialism, the expansion of trade, and the exploitation of the New World. These events have enriched the sources of subsistence and permitted a new growth of population.

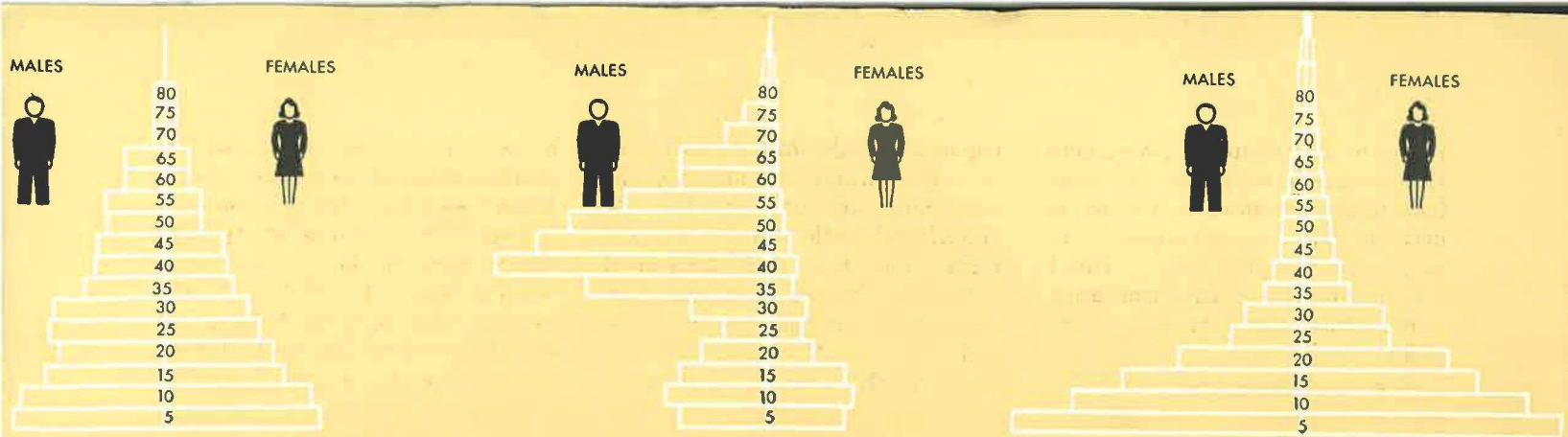
To list the total number in a population or even to define its rate of growth does not tell the whole story. A population not only has size; it also has structure. By this I mean that populations are composed of different kinds and categories of people, the numbers and relationships of which vary from time to time and from place to place. If we classify a given population according to sex and age, we can plot the percentage of the population in every category. Normally, the result is a pyramid with the most numerous class where one naturally expects it, in the youngest age at the bottom, and the least numerous among the most aged at the top. Such a pyramid tells us much about the past, present, and future of the population it represents. If the pyramid has a relatively broad base, we may anticipate, other things being equal, a rapidly growing population, since the future reproducers of the populations are to be found in the youngest generations. On the contrary a population barely replacing itself will have a relatively narrow base.

The profiles of the populations of the United States and various western European countries reveal a striking change during the past century. As the death rate has declined, the number in the older age classes has increased. At the same time the base has contracted due to the reduction in birth rate. We see, therefore, a change in the age structure of these populations that has had a profound significance not only on the growth



▼ THE TYPICAL S-SHAPED CURVE of population growth, here represented by France, shows a slow beginning followed by a rapid rise and finally a gradual leveling off. The curve for the United States, rising from just under four million in 1790 to 132 million in 1940, would show a rising slope that has scarcely begun to flatten out

rate. In pre-industrial societies and among most primitive groups, this perhaps more than the birth rate is responsible for the dynamic status of a population. There are exceptions, to be sure, but in general a population not appreciably affected by artificial checks on the birth rate will increase as its death rate drops, and will become static when the death rate approaches the birth rate. In the past, the rise of the death rate through epidemics, famines, war, or disease has been more effective in reducing the



After Andrew W. Lind

▲ UNDER NORMAL CIRCUMSTANCES there are more young people than old ones in a given population, and the age groups between show a fairly regular decrease in numbers. Note also that the number of males (*left of mid-line*) is approximately equal to the number of females (*right of mid-line*). This diagram shows the total population of the Hawaiian Islands in 1930

▲ BUT WHEN YOUNG and middle aged men without wives or families move into a region, a bulge appears on the male side of the population pyramid. The diagram above shows this in the Chinese population in Hawaii in 1910

▲ WHEN YOUNG PEOPLE predominate in a population, the pyramid has a wide base and thin top, as in the case of the Asiatic-Hawaiian population in 1930. This diagram shows that mixed marriages have been fairly recent and productive, and the children have not had time to grow up

of the population but also on its biological and sociological characteristics. As the senile and old increase, the rest of the population have to shoulder a greater burden, made up of those who not only are non-productive but are also in need of care. The social agencies to tend the chronically ill and the incurable, and the financial obligations to support the superannuated increase at an alarming rate. The number of productive workers to discharge these growing social responsibilities becomes relatively fewer. This in itself might have a ramified series of reactions on the social organization, but how far their effects may be modified by technological advances that make up for the relative loss of workers cannot be easily estimated.

An aging population, or to be more exact a population with an increasing proportion of middle-aged and senile individuals, may influence the social, political, economic, and intellectual orientation of a nation not only directly through its voice in the government but also indirectly by more subtle means. Even though we may not have at hand objective evidence on this possibility, it is a legitimate field of inquiry. One cannot help but wonder whether a young Elizabethan England would have approved of the cautious, elderly appeasers of Chamberlain's England. I do not, of course, wish to imply that the difference between these two eras was simply a matter of the age of their respective leaders. I am aware, moreover, of the complicated back-

ground of the pre-war situation. And I know that Mr. Churchill celebrated his 70th birthday just the other day. But is it altogether unreasonable to expect the policies of nations to reflect the age of the policy makers and of the electorate?

Age and sex, however, are not the only components of population. Indeed, the only limit to the breakdowns and the classifications to which a national aggregate may be subjected lies in the records available. Most of them, however, are temporary and ephemeral characteristics of little or no biological importance. Even much of the census information serves no biological ends. It may be valuable, for example, to know the extent of illiteracy by states and other things about the educational status of the populace. Economists may find statistics on home ownership extremely useful. But these data have no bearing on biological structure. Even the age and sex classifications fail to tell us much of the biological quality of the people. Yet it is of paramount interest to know what hereditary differences in quality exist and whether the superior or inferior individuals are increasing more rapidly.

For example, the composition of a population divisible into 3 distinct groups, would undergo changes proportional to the rates of growth of each group. The accompanying diagram indicates the magnitude of change in a hypothetical case within the bounds of probability.

Such changes in the relative strength of diverse components in a

population are much more common than we have come to realize, because our data are rarely presented in this form. Yet we may see in the course of the nineteenth century the Scotch drop from 15% to 10% of the combined population of England, Wales, and Scotland. In the United States, immigration and differentials in birth rates changed the population from a predominantly English one to one in which German, Irish, Italian, Polish, and other continental nationalities represent considerable percentages, with a relative if not an absolute loss in the English contingents. It is interesting that this tendency, in force for a century, and one that alarmed certain writers, seems now likely to be reversed to some extent. At present the agricultural south, largely British in origin, is furnishing a disproportionate share of the national increase. The high birth rates of the newer immigrants, formerly viewed with foreboding, have dropped below those of the mountain whites of the South. I cite these figures not because I consider the groups significantly different but to illustrate the possibility of a rapid shift under the influence of persistent trends.

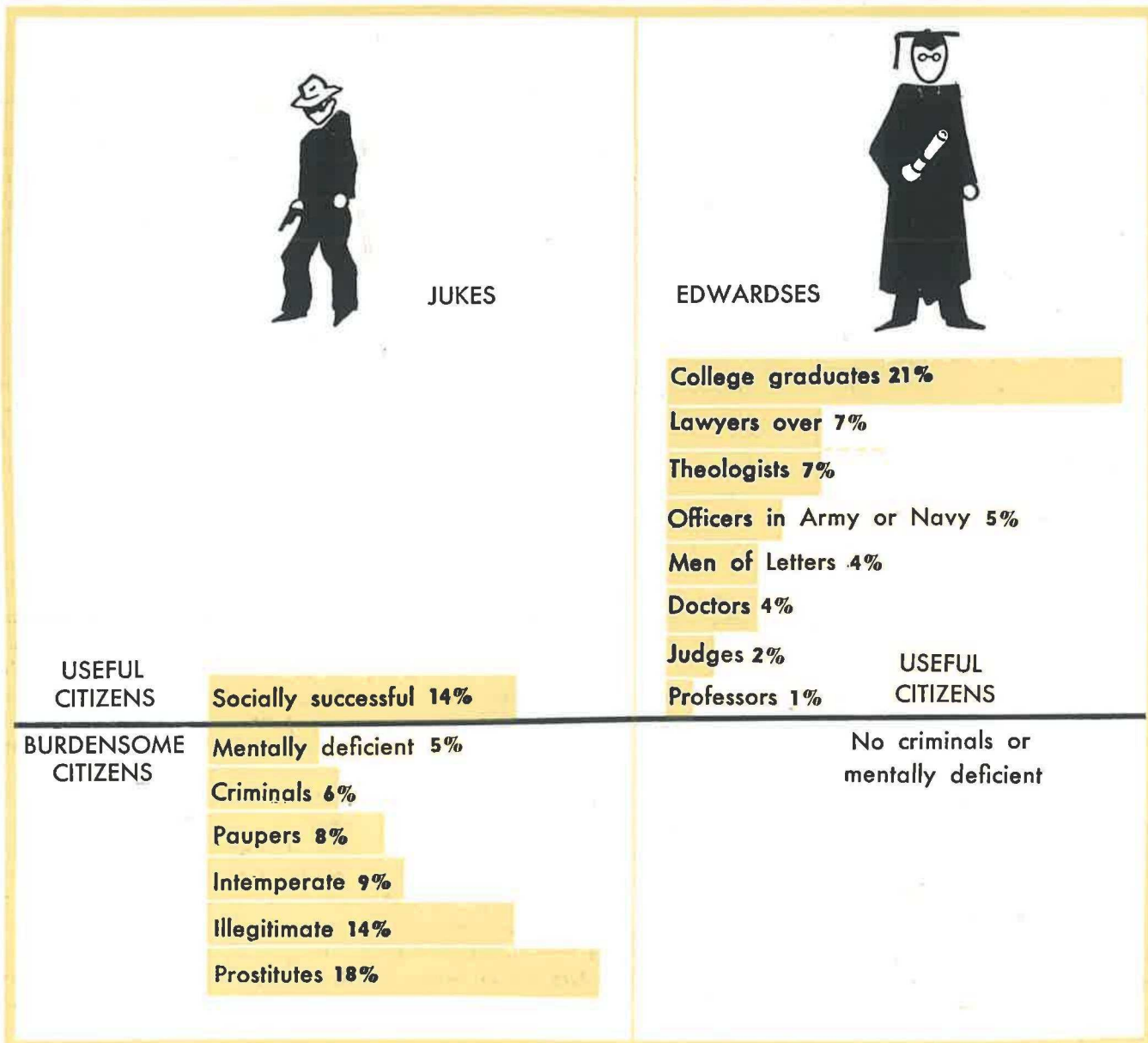
If therefore, a total population may radically change its group composition, is it not possible that its biological quality may also undergo alterations? If the Kallikaks and the Jukes, overburdened with degeneracy, outbreed the Edwardses, may not the qualitative character of the total population suffer? To deny the possibility would be purblind, to affirm the

reality would require, however, more knowledge than we possess. Our measures of quality, however, are still so nebulous and are complicated by so many non-biological factors that I hesitate to accept any conclusions drawn from such inadequate yardsticks.

It is true that the poor are breed-

ing more rapidly than the rich, that the rural sections are supplying the populations for our cities, that the agricultural south is increasing at a higher rate than the agricultural north, that Catholics have larger families than Protestants and Jews. But such differentials can only alter the biological character of a population

if they are correlated with inherited, qualitative distinctions. Such correlations based on reliable evidence are lacking. The only trustworthy associations seem to run in family lines and not by groups. This is perhaps the key, as it is in so many group statistical studies. We must consider the individual and not his group.



▲ WHEN EXTREME examples are analyzed, it is clear that families differ widely in their contribution to society. The "Jukes" family, embracing 2,094 descendants, have cost the State over \$2,000,000. The Edwards family, of whom 1,394 descendants have been traced, have given the nation an impressive number of intellectual leaders. The relative importance of heredity and environment is not evaluated in this analysis

➤ A POPULATION can change its composition profoundly in a few generations if the various components increase at different rates

