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THREE COMMENTS ON THE NEAR FUTURE OF MANKIND

It seems impossible to foresee man's future. However, we do see clearly that the past determines our present in many realms: language, concept of the world, religion, science, law. Moreover, certain biological and physiological conditions appear to be so characteristic of the human species that we would not really be concerned with humanity if men managed to free themselves of these conditions.

Thus the present largely determines the future, and even today, unwittingly, we are determining for some centuries the living conditions of our progeny. We would like to show here, by three examples, that one can already define and foresee such orientations and to show what profound changes these determinations imply for tomorrow's humanity, in relation to its traditional counterpart.

Such research can also teach us what is really important in the major decisions of the present world and what is much less so, no matter what we may think. Thus, by being more aware of the distant but ineluctable

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consequences of our present decisions, we should, perhaps, be able to inflect them and take the measures necessary for man to be able to avoid, or at least diminish, their inconveniences, without altogether renouncing their benefits.

The system I have followed in making these inquiries is simple, and I hope good in principle: *to identify the phenomena which have a long-term development,* which by reason of their own nature have a duration measurable in *centuries,* and which, unless altered by catastrophe on a world-wide scale, would not deviate over a period of twenty or thirty years. This method, then, must, a priori, keep me from divination and prophecy and hold me to the level of experimental science. It could easily occur, however, that I make grave errors in such complex inquiries; that is why I ask the reader to consider these comments as topics of reflection and discussion. Moreover, since forecasting, like all human skills, is the generator of action, and since action is capable of eventually modifying reality, I have no intention of describing here what will be in the year 2200 but, rather, wish to consider the tendencies which would have a chance of prevailing if the unconscious decisions of our age were to remain such and continued to prevail. Furthermore, in order to avoid too strict an interpretation of my thoughts, which would lead to absurd misconceptions, I have deliberately inserted an element of fantasy into the figures which I quote in order to oblige commentators to exercise their critical faculty.

The first of my three examples is extremely important: it touches upon the very nature of humanity and has innumerable consequences for the physical, intellectual, and moral life of each individual. This is the lengthening of the average life span.

The two other examples can be considered to a certain extent as consequences of the first and as reciprocal consequences of each other: these are the problems of the amount of space and of the stabilization of the total population.

I. THE AVERAGE LIFE EXPECTANCY AND ITS CONSEQUENCES

Of all human problems, that of the actual length of life is the most important, for, to be a man, one must first be alive. Everyone knows that the advances in hygiene and medicine, on the one hand, and in the level and way of living, on the other, gradually raise the *average* expectation

of life. It is also known that the individual's maximum life span has not been increased, and specialists realize that our present knowledge does not allow us to hope for any success on this point. We will admit, then, with Jean Bourgeois-Pichat that a man of the year 2100 will live, on the average, for eighty years, but no more;[1] if one were able to increase this figure, the problems that we are going to raise here would only be more acute.

This, then, is what is known by every reader of this article, and each can deduce its numerous consequences in many fields. However, this phenomenon has been studied thus far much more with respect to great numbers than to the life of each individual; furthermore, as soon as one wishes to specify these consequences, precise details, which we did not possess until recent months, become necessary. To envisage the future, it is indispensable to have some reasonably clear knowledge of past evolution; what, then, were the former conditions of humanity, the conditions in the course of which our moral norms, philosophical principles, and legal rules were formulated? Still more specifically, what was "the demographic calendar of the average man" with the average life expectancy of former times, and what will it be when the average life span is eighty years?

As the reader will see, this is how we refer to the over-all compilation of dates and periods of time of the essential stages of life: age at marriage, number and dates of birth of children, age at which a man loses his parents, number and date of bereavements, etc.

Now very little was, and still is, known on these questions. However, the (French) National Institute of Demographic Studies permitted me to attempt an incursion into this realm, the general results of which I shall now present (see Table 1).[2]

The traditional expectation of life for our ancestors until about the year 1800 was not of a life "biographically complete." The missing information is becoming calculable through the systematic analysis of the civil registers of certain parishes.[3]

1. J. Bourgeois-Pichat, "Essai sur la mortalité biologique de l'homme," *Population*, No. 3 (1952).

2. J. Fourastié, "Recherches sur le calendrier démographique de l'homme moyen de la vie traditionelle à la vie 'tertiaire,' " *Population*, No. 3 (1959).

3. E.g., E. Gautier and L. Henry, "La Population de Crulai, paroisse normande," I.N.E.D. *Cahier*, No. 33, 1958.

TABLE 1

SOME PAST, PRESENT, AND FUTURE CHARACTERISTICS OF THE "DEMOGRAPHIC CALENDAR" OF THE AVERAGE MAN AND WOMAN IN WESTERN EUROPE

	About 1730		Today		About 2000	
	M	F	M	F	M	F
Life expectancy at birth (e_0).....	25	25	72	74	77	78
Infant mortality per 1,000 born alive	250	230	22	20	11	10
Average age at marriage.....	27	25	26	24	26	24
Number of persons per 1,000 born alive reaching this age.....	425	440	932	952	984	989
Median age at death of married persons.....	51	51	72	77	79	81
Average length of marriage.....	17		39		46	
Median length of marriage.....	15		41		48	
Average number of births per marriage (France).....	4.1		2.3		..	
Average age of average child at the death of the first deceased of his two parents.....	14		40		55	

From these studies it would appear that the average life, or the expectation of life, at birth, was of the order of twenty-five years in France at the end of the seventeenth century and the beginning of the eighteenth. For certain particularly sorely tried generations this figure could, in Old Europe, drop to the region of twenty years. *It is these numbers—twenty years, twenty-five years—which give full significance to the presently foreseeable figure: eighty years.*

In the past, out of one thousand children born alive, an average of about 430 or 440 reached the age of marriage; tomorrow it will be 985. Taking into consideration celibacy (which accounts for about ten per cent of mankind today, as it did in the past), an average of 4.5 children per household, with expectation of life $e_0 = 25$, was necessary to *maintain* the total number of the population.[4] Tomorrow 2.2 children per household will suffice.

The average ages at first marriage have varied little since 1700, at least in France: they stood at twenty-seven years for men and twenty-five for women; today they are twenty-six and twenty-four. Today, as in the past, one marries *for life,* but in those days this life together lasted seventeen years on the average; only one household in two reached its fifteenth wedding anniversary. Tomorrow, life together will last for forty-six to forty-eight years.

4. The symbol e_0 indicates the life-expectancy at birth, that is to say, at age 0. One can, indeed, calculate the life expectancies at different ages, which one then indicates by e_{10}, e_{25}, etc. (average number of years to live for those reaching the ages of 10, 25, etc.).

In former times it was at the age of fourteen, if he reached it, that the average child saw the first of his parents die; tomorrow it will be at the age of fifty-five. We are naturally pleased with this but must point out the following: with $e_0 = 80$, more than half the private riches of a nation will belong to men and women over seventy-five years old.

Formerly, parents died before having completed their children's education; tomorrow, supposing that the ages at first marriage remain what they are today, a normal couple will live for twenty or twenty-five years after the marriage of their youngest child.

At the end of the seventeenth century in France, but probably in the rest of the world as well, the life of the average father of a family, married for the first time at the age of twenty-seven, could be summarized thus: born into a family of five children, he had only seen half of them reach the age of fifteen; he, like his father, had had five children, of whom only two or three were living at the time of his death.[5]

This man, living, on the average, until the age of fifty-two—an attainment which was fairly uncommon, ranging him in the venerable ranks of old men—had (without speaking of uncles, nephews, and first cousins) known an average of nine persons of his immediate family, among whom there was only one grandparent (the other three having died before his birth), his two parents, and three of his children. He had survived two or three famines and, in addition, three or four periods when the price of grain was high because of the poor harvests that came, on an average, every ten years. He had survived his own sicknesses and those of his brothers, his children, his wife, and his parents; he had known two or three epidemics of infectious diseases, not to mention the semipermanent epidemics of whooping cough, scarlet fever, and diphtheria.

Even an imperfect assessment of the human condition will enable one to understand how different an attitude these new increases in life expectancy must bring about in the mind of the average man. In former times death was in the midst of life as the cemetery is in the middle of a village. Since then, death, poverty, and suffering are retreating. They are no longer considered as man's harsh companions, created to constrain him to the spiritual life and to moral progress, but, like accidents

5. The United Kingdom was able to break away from the traditional situation a little earlier; but a half-century, more or less, is not important in this matter.

and amputations, as unfortunate happenings, contrary to man's true nature and not only to be fought, but minimized and concealed.

The individual legal, philosophical, and moral consequences of this lengthening of the average life span are thus considerable; but the social consequences are no less important. For example, one can neither fully understand the history nor envisage the future of the working class during the past hundred or hundred and fifty years in the countries studied without taking into account the average age of industrial workers.

The results of our research in this area are given in Table 2.[6] Of course, it only deals with approximate ages—the figures obtained by our calculations were rounded out to the full year because we do not believe that they can be looked upon as accurate to within one year—but, on the other hand, they do appear to constitute an upper limit of the reality, if only because we have adjusted the distribution by age of the *total* population to a *working-class* population which is, in fact, much more subject to early death than is the average.

TABLE 2

AGE OF THE MALE WORKING-CLASS POPULATION IN FRANCE

	Time					
	About 1750	1801	1851	1901	1954	1975
Average age	26	27	30	33	38	42
Median age	22	24	26	28	34	39
Age of the youngest	10	9–10	10	13	14	16
Number of illiterates per 100 workers	85	75	40	20	5	3

The figures for 1901 are derived from the census of that year and constitute a valuable check on the series, since the earlier figures have been *calculated* by us whereas those for 1901 are *given* to us by research of the time.

The amplitude of aging is such that it cannot be concealed by the inaccuracies of the calculation. It is incontestable that the average age of the workers in our factories was about twenty-seven to twenty-eight in 1830 and is thirty-nine today; it will reach forty-two toward 1975. *In 1830 one worker in two was less than twenty-five years of age;* today

6. Cf. J. Fourastié, "Le Personnel des enterprises, remarques de démographie et de sociologie," *Population,* 1960.

more than one worker in two is over thirty-five years old, and in 1975 one worker in two will be over thirty-nine.

However, these figures summarize the situation of the total French working class, including artisans, and, as we have said before, takes the general mortality into consideration. If we make more accurate investigations, and if we confine ourselves to the poorest fraction of the working population, we should expect still lower average ages. As an example, we have made the calculation for the "common mill-hands" of the town of Mulhouse, whom Villermé accurately describes (1823–34).[7] These calculations give an average age of twenty-six and a median age of twenty-two.

II. THE PROBLEM OF STABILIZING THE POPULATION

The individual, family, and social consequences of the lengthening of the average life are, then, strong enough to bring into question humanity's underlying behavior, its moral climate, legal institutions, and attitude to life. It is, however, the truly demographic consequences which seem most important; they will have a great bearing upon the future of humanity.

Indeed, the single fact that less than 450 per thousand children born alive reached the average age of marriage in traditional humanity, whereas about 980 will reach the average age of the end of conjugal fecundity in the future, implies for the near future a fundamental tendency toward the rapid increase in the number of living humans on the earth.

I wish to become involved as little as possible in the great debate which, for at least a hundred years, has brought the "Malthusians" and the "Populationists" to grips; a debate which today is more lively than ever and to which the Marxists are adding the weight of the realities of the Chinese. I wish merely to bring forward some unknown or neglected aspects of the problem, after recalling the numbers of the total world population as accepted today: man's appearance on earth goes back five or eight hundred thousand years; four thousand years before Christ humanity still had less than 10 million members; 100 million at the birth of Jesus; and 2,400 million in 1950; there will be 6,300 million

7. Villermé, *Tableau de l'état physique et moral des ouvriers des manufacturers de coton, de laine et de soie,* XI, 251, 375.

in the year 2000, according to the projections (mean estimate) of the United Nations' competent service.[8]

I do not wish to deliberate further on the level of stabilization which humanity will reach, nor even on the question of knowing if there will be an effective one, although this seems to demand an affirmative answer. My problem here is to consider the types of humanity which would result from the levels of population. To specify the types implied demands long calculations and developments which go far beyond the framework of this article, and we shall confine ourselves here merely to outlining some aspects of the problem.

First of all, one must make hypotheses on the conditions of habitability of the planet. Of the extreme hypotheses, one is that man does not in any way modify either the physical geography of the world or the climates (Hypothesis A); the other is that man nullifies the inclination of the ecliptic and, generalizing the force of the *cariocas,* fills in a part of the seas by tipping the mountains into them, so that all firm land would become habitable (Hypothesis B). With Hypothesis A there would be scarcely seven billion hectares in which one might live without feeling one's self to be in a state of political exile or scientific experiment; with Hypothesis B there would be fifteen billion hectares.

This being so, in order to characterize the types of humanity cited above, it will be enough to refer to Table 3, which gives figures well known to geographers.[9]

It is easy to calculate the world populations that would result from the extension of the various densities mentioned in this table. I would simply say, to introduce that which I shall develop below, that each of the seven billion hectares of Hypothesis A is already (1960) more heavily populated on the average than was each of the thirty-five million hectares of the France of Louis XV. It may also be noted that in the year 2000 these same seven billion hectares will have a slightly higher population density than that of present-day France (0.9 inhabitants per hectare as against 0.8).

8. The figures published by the United Nations are as follows: high estimate, 6.9 billion; mean estimate: 6.28 billion; low estimate: 4.88 billion (United Nations, *Études de population,* No. 28 [New York, 1958]).

9. The densities of these countries are calculated here on their total geographic area. It is clear that a great part of these lands is only effectively cultivable and habitable in a hypothesis similar to Hypothesis B.

TABLE 3

NUMBER OF INHABITANTS PER HECTARE OF VARIOUS POPULATIONS

Paris, municipal limits, 1959	280
Built-up area called "Paris," 1959	50
Paris, densest neighborhoods, 1959	800
Paris in fourteenth century	700
New York, 1950	100
Washington, 1950	50
London, 1956	45
West Berlin, 1957	46
Imperial Rome	700
Belgium and Holland, 1958	3.4
West Germany, 1959	2.2
England, 1957	2.2
France, 1959	0.82
France, 1750	0.4
Mainland China, 1957	0.65
United States, 1959	0.23
U.S.S.R., 1959	0.09

As for the densities which the city of New York supports at the present time, they would permit sustaining the life of 700 billion human beings under Hypothesis A and 1,500 billion under Hypothesis B. In the rate of growth foreseen for the years 1950–60 (100 per cent increase in forty years) these numbers would be reached in the year 2200 (Hypothesis A) and in 2310 (Hypothesis B).[10]

In comparison one may recall that the total population of the world in 1935 could have been contained in a single town having the density of Paris and a diameter of the distance between Chartres and Rheims.

I do not believe my earlier use of the term "types of humanity" to designate the populations which have resulted, are resulting, and will result from these different densities, to be out of place. Indeed, these figures of density are so widely different that they imply radically opposed kinds of life, themselves engendering intellectual and physical climates without analogy. It is easy to think that, between the situation of man living in a natural milieu such as the France of 1750 and his situation in a vast town with the density of New York and spreading over thousands of kilometers, there are factors in common with the respective situations of animals living in virgin nature and those in our

10. It can be seen that Hypotheses A and B, which are so different from each other in the technical and geographical point of view, differ very little in the demographic viewpoint.

zoölogical gardens. The least one can say is that the problem is worthy of examination and that we have little time (three hundred years is nothing for adjusting a biological problem) in which to solve it.

What is, in effect, shown by the figures of Table 4, is the relative sensitivity of the phenomenon to moderate or even weak rates of growth and thus the difficulty which mankind will experience in containing it once a certain level has been reached. As is classic in matters of geometric progression, the absolute numbers become so great beyond a certain level that even a very heavy and drastic reduction of the coefficient of growth does not prevent the exorbitance of the absolute increases. From the time of Pericles to the year 2000 the global population will have been multiplied by about 100 (in twenty-five hundred years), but *an equivalent increase* (that is to say, a new mulitiplication by 100) *would lead to average densities of 100 persons to the hectare.* These same figures show the *small value of solutions of the cosmic type* (passage from Hypothesis A to Hypothesis B as described above, populating the Moon or neighboring planets. These solutions which require vast technical feats would provide only very slight easing of the situation once the number of human beings were in the region of a hundred billion (the surface of the Moon is only one fiftieth of the Earth's, that of Mars a quarter; only Venus is of the same dimension as Earth, but astronomers today admit that it is very inhospitable).

The most striking fact is the opposition which exists between man's natural biological faculties of reproduction and the perspectives opened

TABLE 4

GROWTH RHYTHMS AND DATES AT WHICH, ACCORDING TO THESE RHYTHMS, POPULATION DENSITY WILL REACH TEN AND ONE HUNDRED INHABITANTS PER HECTARE OVER SEVEN BILLION HECTARES

Growth Rhythm	No. of Years in Which Population Doubles	Date Density Reaches 10 Persons/Hectare	Date Density Reaches 100 Persons/Hectare
Average of six children per family (natural birth rates)	20	2,050	2,110
Average of four children per family.	31	2,105	2,190
Present world view (median hypothesis, United Nations, 1950–2000)	40	2,150	2,270
Present rhythm (1953–58) of China.	35	2,135	2,240
Present rhythm (1950–58) of the United States	47	2,180	2,320
Average of three children per family.	65	2,235	2,420
Present rhythm (1955–59) of France.	105	2,370	2,715

by the raising of his average life expectancy to eighty years. The increase noted from Pericles' day to our own has been achieved with natural fecundity (about 4.1 or 4.2 children, on average, to the average marriage, which corresponds to an average of about six children per complete family).[11] Now, in the future almost all families will be complete families. Moreover, the advances in medicine, in the interest of the individual, reduce and will reduce the incidence of congenital sterility. Natural fecundity would, then, produce at least six children per average family. Assuming a constant rate of celibacy, about ten per cent, a reproduction rate of 1.65 would double the number of the potential parents in twenty years, which would lead humanity into a rate of growth twice as rapid as the present and, beginning with the present population of three billion, would mount to 700 billion in a century and a half.

I say this only to show what would be produced in the near future by the *extension of the millenary birth rate,* which demographers call the "natural or spontaneous birth rate." If one assumes that this is excluded, one assumes that the sexual behavior of present-day and future mankind differs, and will differ, greatly from his natural behavior. Table 4 shows that, *even with the birth rate greatly reduced, the long-term increases remain large.* Notably, an increase of 100 per cent is produced in sixty-five years by this rate of an average of three children per family, a rate which seems very restrictive from the individual and family point of view in a wealthy society where the problems of patrimony are hardly posed; where full employment, the reduction of professional work, comfort in the profession, and abundance of leisure more or less relieve parents of the worry of *establishing* their children; where, finally, the risk of death, suffering, sickness will be reduced to very low degrees in both young and adult years.

However, the essential object of Table 4 is to point out that *the demographic problem will become one of the great problems of the near future of mankind.* It may be conceded that it will become acute in the region of densities of ten inhabitants to the hectarer (seventy billion people); now, even with the rate of growth of "highly developed countries," like the United States, this point of great sensitivity would be reached at a time when the great-grandson of my grandson would

11. A *complete* family is a family in which both parents are living at least until the mother reaches the age of 50.

normally be alive. Contrary to general opinion, there is seen to be little difference, from the point of view of great numbers and the dates of their attainment, between the birth rates of the United States and of the whole of the rest of the world today (only thirty years delay in reaching the density of ten and fifty years for the density one hundred); between even the Chinese rhythm and that of America, the delay in reaching the density of ten is only one of forty-five years! Only a very much slower rhythm, such as that of France today, substantially postpones the attainment of very great numbers while keeping them astonishingly near if seen from the point of view of millenary mankind.

It will also be noted that what some generations have done, other generations can undo. By limiting to one the number of children per household a human race would be found, after the death of the parents, reduced in the ratio of ten to four and one-half; perhaps our descendants will have recourse to spasms of this kind, that is to say, to successive pulsations of growth and contraction, each phase summoning up contrary reflexes. But it is seen that, even through such rigorous, only-child rationing, four generations would be required to return from a density of ten to the density of one-half which was that of France in 1750; and, as will be suggested below, economic and social conditions seem to forbid—or at least to render extremely perilous—such deflations, or even much more gradual deflations, to mankind.

Table 4 tends, then, to define the types of humanity which would prevail in the near future if the marriage and fecundity rates observed in certain territories at this time found themselves made general throughout the whole world. Supposing that at a certain date everybody became of the opinion that it was necessary to reach a stationary level of population at a fixed number and date, it does not appear that man would even then be secure from serious difficulties on this account. Indeed, man has never experimented with the situation as a stationary population with raised life expectancy, and the little we know of this situation does nothing to prevent the raising of serious anxieties. We know, in fact, that demographic stagnation has characteristic and grave economic, social, and moral effects; Alfred Sauvy has described them with precision.[12] In such a population the age *pyramids* would become almost *rectangles;* there would be almost as many persons aged sixty to eighty as there were children and adolescents under twenty years of age.

12. A. Sauvy, *Théorie générale de la population.*

More particularly, the decisions that limited the number of the population to a fixed figure would have to be deliberate, whereas *traditional humanity never knew any but unconscious mechanisms in this area.*

III. THE QUANTITY OF SPACE

The millenary situation of mankind is, in fact, very distinct; as already mentioned, it was hygiene and the standard of living which determined the death-rate and that this "natural" death rate counterbalanced the natural fecundity to the point of not allowing any increase, or only a very slight one. However, it is clear that, even if hygiene and medicine had been improved, the traditional standard of living would, in the past, have sufficed to close the dam on demographic expansion. Indeed, as our ancestors well knew, it was food which limited the population by the pitiless rigor of famine. The very slow advance in agricultural techniques thus had as a corollary a very slow increase in the total population. In the eighteenth century two hectares of average land in a temperate climate were still needed to feed one man. *Forty million arable hectares in France fed twenty Frenchmen.*[13]

Today, with already usable (I do not say used) techniques, two hectares can nourish, more decently than in the past, not merely one man, but from ten to twenty, and tomorrow it will be thirty or forty. This would permit population densities per hectare of *about the degree of present-day London or Berlin.*

The unconscious and brutal, but effective, mechanism which would limit the proliferation of the human species as it does all animal species,

13. "The man worth forty crowns: How many *arpents* do you think there are in France? —The geometrician: One hundred and thirty million, of which almost half [55 million hectares] are (sterile). . . . The land with a good yield could be reduced to seventy-five million square *arpents;* but let us count it as eighty million. . . . How much do you estimate every *arpent* yields on an average, in the average year, in wheat, all sorts of grain, wine . . . cattle, fruit, wool, silk, milk, oil: . . . The geometrician: If each produces twenty-five pounds it is a lot" (Voltaire, *L'Homme aux quarante écus,* in *Contes et Romans,* III ["Les textes français"] (Paris: L'Association Guillaume Bude)]), pp. 16 ff.

Twenty-five pounds represented at the time the average price, over a long period, of a *quintal* of wheat. The total production of France's soil was thus the equivalent of 80 million quintals of wheat, say, 4 quintals per head of the population (one kilogram per day and per person). It can be understood that *nourishment* was close to its limit. For a closer examination of the question see my book *Machinisme et bien-être,* pp. 140 ff.; in English, *The Causes of Wealth* (Glencoe, Ill.: Free Press, 1960), pp. 142 ff.

that of sustenance, has, then, been effaced. Our problem is to discover if another will be substituted.[14]

Let us try to deal with the problem from the point of view of the amount of space, leaving to other studies, or other investigators, the task of examining it under the numerous and no less important aspects which it necessarily entails.

Man occupies, uses, or consumes space—geographical localities on the surface of the earth. Schematically, we shall say that these localities are necessary to him in order to satisfy four types of need: needs for agricultural produce necessary for his nourishment; needs for manufactured products; needs for shelter; and, finally, needs for movement (exercise, strolling, sport, tourism. Let us call these four "quantities of space" needed by the average man h_1, h_2, h_3, and h_4, respectively. Let us then observe that h_1 and h_2 are easy to measure with accuracy with the aid of the usual statistics; h_3 is already a little more nebulous; and h_4 is almost impossible to calculate.

The important fact, however, is that in comparing present-day with traditional life it is easily observed that the advance in production techniques and its consequences, the improvement in the way of life and in the standard of living, have as a result the constant reduction of h_1 and, on the other hand, the increase in h_3 and h_4. As for h_2, it appears that it has to reach a certain maximum and then no longer increases.

As has been said above, for the average man of the eighteenth century, h_1 was about two hectares of good ground in a temperate climate; h_2 was very small, the plants, factories, and artisans' workshops representing very little at the time; h_3 was very small for the average man, with people crowding themselves four or five into a room sixteen meters square (but, it is noteworthy, on the order of one to two hectares for the wealthy classes—châteaux, parks, gardens—an essential phenomenon on which we shall dwell below); finally, h_4 was small as a *need,* the low standard of living and the mediocre techniques depriving the

14. Of course, discussion is usual to establish whether the problem of food is effectively solved or whether, on the contrary, the underdeveloped countries are not going toward new famines; but this has been debated very often, and I have no new items to add to the dossier. That is why I prefer to deal with the following problem: *Supposing* the problem of food to be solved, are there other unconscious and coercive mechanisms to limit the number of human beings? It does appear to me to be established that the problem of food is about to be effectively overcome, that is to say, taken over two or three centuries (especially if one thinks about the ***cultivation of the sea***).

average man of transport and of wishes of a kind pertaining to travel; but it was very big as a *possibility,* the world still being almost empty of men.

Thus, it was the value of h_1 that limited the total number of the population until the dawn of the industrial revolution. However, contemporary progress is ceaselessly diminishing h_1. It is already in the region of one-third of one hectare, certain good agronomists placing it at one-tenth; it will surely be much smaller still around 2100 and 2200. Even if it makes its dragon-like determinism harshly felt in certain nations in the course of the next fifty or eighty years, *it will probably no longer be this factor that will, in the future, determine the number of human beings.*

This *primary* regulator having been defeated, will h_2, the amount of space with respect to industry (*secondary* sector) be substituted for it? No, for we see clearly that industrial establishments only count for a few square meters per head of the population today and have every prospect for doing so in the future.

One must, then, look to the *tertiary;* h_3 is the most distinct of these factors and grows noticeably with the standard of living. The little capital of my native district, Cahors, lived inside the same city walls since the time of the Romans. Since 1945, without its population having increased, it has burst its medieval ramparts and almost doubled its area.

However, this is only a question of a few square meters per inhabitant: about one hundred (house plus green area), according to the norms of the most pleasant neighborhoods of Washington; two hundred according to the norms of Pedregal in Mexico, one of the two or three residential districts in the world today of which the connoisseurs hold a high opinion.

Since one hectare is equivalent to ten thousand square meters, it can be seen that, of the three items, h_1, h_2, and h_3, and according to present trends, h_1 will still probably be the biggest towards the year 2100; but the total of the three may easily be less than one thousand square meters, which will allow densities of ten men to the hectare.

There remains the term h_4, also of a tertiary nature, but vague. Since it is much more qualitative than quantitative, we can only attempt to define it by having recourse to memories of our travels, to our emotion in the fact of discoveries made in the world, to the prestige of explorers,

pioneers, and Alpinists; it is thus possible that our descendants will know, only through our books, "the hope of arriving late in a wild place."

Inveterate calculators will be able to estimate the number of people who would jostle each other on the hundred kilometers of beach along the French Côte d'Azur if each of the 500 million Frenchmen were given permission three times, or even once, in his lifetime to spend a month or two weeks there.[15] They can likewise calculate how many meters of beaches with Mediterranean or tropical climates are at the disposal of each Russian, each Chinese, or each Hindu today, and how many kilometers of artificial beach it would be necessary to construct so that each one might come to spend there two weeks of paid holiday. Many serious men will belittle this sort of calculation.

It seems to be of interest, however, to show the distortions which will exist between yesterday's mankind, today's, and that which we are on the way to begetting. Our civilization is today oriented toward the increase in the quantity of consumer goods and toward the reduction of the amount of space. The rich man of the eighteenth century had only a horse-drawn carriage, a few mirrors, hardly any books, and no refrigerator. The average man of tomorrow will be rich, much richer than was the rich man of yesterday in food products and in manufactured goods; he will be gorged with vitamins, oranges and pineapples, aeroplanes, electric razors, and even classical music—but when the contemporary of Voltaire was rich, he had a large house in the heart of a vast park, an island of humanity in an almost virgin Nature. That allows us to dream of what life in Western Europe would be today if the advance in the standard of living could have been accomplished since the eighteenth century while maintaining a fixed level of population. Despite his almost immeasurable primary and secondary riches, our rich grandson will neither be able to live in nor build himself such houses because of lack of space; to know their charm and civilizing value, he will be reduced to buying his ticket and joining the nostalgic and interminable flock which, in the last fifteen or thirty years, has already begun to file through our stately homes at Vaux-le-Vicomte, Champs, Anet, Malmaison, Dampierre, Courances, Ormesson, Chamarandes.

15. 550 million are equal to the density of ten to the hectare; with the density one hundred it would be 5,500 million. This calculation is of interest even for figures on the order of 100 million.