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POPULATIONS

FUNDAMENTALS ON THEIR EVOLUTIONS

1994

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Is there really "overpopulation" in poor countries?
Is the process of depopulation increasing in Europe?
How is it that a population may go on increasing whereas fertility decreases?
Would the earth have insufficient resources?
What is birth rate?
Of which pyramids do demographers talk about?
What is mean age? Life expectancy?
Can demographers make mistakes?
Does AIDS increase the mortality rate?

All these questions get to the heart of the actual debate on demographic policy. In simple and concrete words the author answers them, illustrating them with numerous examples. The four fundamental operations suffice to understand these elementary and simplified notions.

The author's unique aim? To open the way to a better knowledge about essential human phenomena: life, love, death.

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Michel Schooyans is a member of the Pontifical Academy for Social Sciences, the Population Research Institute (Washington), and corresponding member of the Association pour la Recherche et l'Information Démographique (Université de Paris-Sorbonne).

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POPULATIONS

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English translation by Agnès COPPIETERS with the collaboration of the author.

PREAMBLE

This work has but one ambition: namely to render service to those who feel shy before the awe-inspiring demographic science. Demography is indeed perceived by some people as being "elitist" as it has recourse to statistics and makes use of several other methods to acquire knowledge.

Yet, even if demographers make use with virtuosity of the most sophisticated mathematics, these are but an instrument for a better knowledge of essential human facts: life, love, death. Before and after the figures, there are always men, women and those who are dear to them.

The study of contemporary ideologies has led us to take an interest in populations policies. To begin this study, a minimum of information on demography was indispensable. It was our privilege to be guided in this initiation by specialists of international renown; we thank them most warmly. We want to express our gratitude in particular to Mr Gérard-François DUMONT, Professor of Demography at the Sorbonne and President of the APRD.

The purpose of these pages is not to start an essay or a discussion on demographic policy. Their aim is to introduce, not to cross a threshold[1]. Our text merely wants to explain the most elementary and therefore important notions, in a simplified form. To give these explanations, we have only used the four fundamental operations.

Compared with the French original text, this English translation is up-to-date and more complete.

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[1] We study these policies in *La dérive totalitaire du libéralisme*, Paris, Ed. Universitaires, 1991; in *Bioéthique et Population*, Paris, Ed. Le Sarment-Fayard, 1994, and in the booklet *El imperialismo contraceptivo. Sus agentes y sus víctimas*, Caracas, Ed. ALAFA, Miami, Ed. VHI, 1994.

So the present work is not meant for demographers. We simply want to share with other citizens, academics, political leaders, students, reporters the benefit afforded by the help and competence of some of those specialists. We hope that in spite of their simplicity, these pages will help to refute some "commonplaces" and will heighten public awareness of the diversity of demographic phenomena.

M.S.

INSTRUCTIONS TO THE READER

• In the body of the text, the reader will often find the indication: "(cf. + number)": he will then refer to another passage which will throw light on the subject.

Example: chapter II, paragraph 1, concerning the structure by age: the indication "(cf. V 4)" refers to chapter V, paragraph 4, where the population pyramid is discussed.

• Between brackets we have given the *French and Spanish translation* of the most important technical expressions.

• Complete *reference* to works mentioned in the text in abbreviation will be found in the Bibliography.

• The *Index of themes* refers to the chapters and their subdivisions.

CHAPTER I

BASIC DATA

1) Demography considers principally three fundamental events: **birth, death** and **migration**.

2) The **time of procreation** for women is considered to be from 15 to 49 years of age. **Fertility** is the capability to give birth to a child; **fecundity** is the real use of this capability. In English, *fertility* is generally used where French uses *fécondité* and Spanish *fecundidad*.

3) The term **reproduction** is applied to women because biological reproduction is ensured by the female sex.

4) Whatever the country, the birth rate for **girls** is habitually **100** against **105 boys**. In other words, there are 105 boys and 100 girls on 205 births.

a) This difference between girl and male births is expressed by talking about *feminity rate* (cf. II 2-3). This rate is constant and is rendered by the following coefficient:

$$\frac{100\ (\textit{fem. birth rate})}{205\ (\textit{total birth rate})} = \mathbf{0.488}$$

b) We can also take 100 as basis for the female sex effective. Then we say that the *masculinity ratio* at birth is of 105%.

5) The word **generation** can have several meanings:

a) A group of persons born the same year: then the word **cohort** may be used. This term designates a group of individuals having experienced

a same event at the same time. *Examples*: a generation is a birth cohort; people married in 1988 make a cohort.

b) The *time interval* dividing two successive generations is equal to the mean age of mothers at the birth of their daughters. Thus one generation generally corresponds to a little less than thirty years; it is the age-difference between parents and children.

6) The demographic data are **estimations** depending on the quality of reliable sources, and in particular those of **census** [***Recensement; Censo*** or ***Empadronamiento***] and of the vital statistics [***Registres de l'état civil; Estadísticas vitales***] of the State — if they exist.

7) The demographic indicators (birth rate, fertility rate, death rate,...) are almost always but **averages**, which do not reflect the diversity of situations inside one same region. So it is that the total fertility rate (cf. II 1) may considerably vary according to areas of one same country.

8) Demographic density is one example of this "average". It expresses the ratio between the number of inhabitants of one particular territory and the area of this territory.

a) Example: According to *Eurostat* (1993) the demographic density of Belgium in 1990 was 326.6 inhabitants per km^2; but it refers to an average which does not show that Brussels counts 5,926.6 inhabitants per km^2 and the province of Brabant 669.4, whereas the province of Namur only reckons 115.2 and Luxemburg 52.2.

b) The territory area is sometimes given in **square miles**. One square mile equals 2.59 km^2.

Example: According to the "World Population Data Sheet (1994)" the area in France is of 212,390 square miles. The demographic density is of 273 inhabitants per square mile. Expressed in km^2, the area of France is of 212,390 × 2.59 = 550,090 km^2; its demographic density is 273 : 2.59 = 105 inhabitants per km^2.

CHAPTER II

THE MOST IMPORTANT INDICATORS

1) Total fertility rate [*Indice syntéhtique de fécondité,* or *Indicateur conjoncturel de fécondité,* or *Somme des naissances réduites; Tasa global* (or *total*) *de fecundidad*]

This is the sum of fertility rates for women between the age of 15 and 49 for one particular year. Because this fertility rate concerns a given period and therefore also called instant index, this rate is said to be *transversal* (cf. III 4): it gives a *section* of the fertility rate of all women in age of procreation in the course of one given year. This rate concentrates generally only on one year. *It is the most important rate to grasp this problem of fertility, and fertility alone,* and especially to *compare* the behaviour of fertility in time and between areas, what the structure differences per age (cf. V 4) may be.

It is worked out by adding up the *fertility rates per age.*

Illustration 1

Total fertility rate of the town of "Rosario" in 1982 (invented)

Birth year of the mothers or generation considered in 1982 (1)	Age of the mothers in 1982 (2)	Number of births born from all the mothers of the generation considered in 1982 (3)	Number of all the women of the generation considered in 1982 (4)	Fertility rate, in 1982, of the generation being considered (3):(4)
1967	15	11	6893	0.0015958
1966	16	18	6503	0.0027679
----------	----------	----------	----------	----------
1958	24	672	5293	0.1269601
----------	----------	----------	----------	----------
1933	49	19	4753	0.0039974
TOTAL (invented) of the **Fertility rates by ages** or *Total fertility rate*				**2.93**

2) Reproduction rate [*Taux de reproduction; Tasa de reproducción*]

It allows to calculate in which proportion a generation reproduces itself (cf. I 3). As we shall see, a distinction must be made between the **gross** rate of reproduction and the **net** rate of reproduction. When the *net* rate equals 1, the generation reproduces itself exactly at the same quantitative level: one generation later, 100 women will be replaced by an equivalent number of women.

Let us invent an **example** relative to a Third World country.

a) The total fertility rate of the town of "Viñedo" in 1961 was 4.1 children to a woman, or 410 children to 100 women.

b) As the masculinity ratio at births is 105% (cf. I 4 b) (and thus the male birth rate of 105 on 205), it means that the births distribution per sex is as follows:

$$410 \times \frac{105}{205} = \textit{210} \text{ boys}$$

et

$$410 \times \frac{100}{205} = \textit{200} \text{ girls}$$

with a *Total* of *410* births

c) Let us point out that the birth ratio per sex can also be calculated by multiplying the fertility rate (number of children for 100 women) by the feminity rate (cf. I 4 a). In the example of "Viñedo", it gives for 100 women having had one child in 1961:

$410 \times 0.488 = 200$ girls
on a total of 410 births.

d) Consequently, if the total fertility rate of the women of "Viñedo" keeps to 4.1, i.e. 410 children for 100 women, *the **gross** reproduction rate* will be:

$$4.10 \times \frac{200}{410} = 2.00$$

This means that one woman will be replaced by 2.00 women in the next generation.

e) Yet, as about 19.5% of girls in this country of the Third World will die before reaching the mean age of motherhood, and that consequently 80.5% of them will survive, the ***net** reproduction rate* will be:

$2.00 \times 80.5\% = 1.61$

So 100 women will be replaced by 161 women in the next generation, if the net rate keeps to the above mentioned rate.

3) The "famous" total fertility rate of 2.1 children per woman or 210 children for 100 women

a) It answers the question: *in a developed country*, i.e. enjoying the best sanitary conditions, what is the necessary total fertility rate to reach a sufficient *reproduction rate* (cf. II 2) only to ensure the simple replacement of the population, i.e. a **net** reproduction rate of 1.00? In other words, what is the necessary total fertility rate for 100 women to be replaced by an equivalent number (100) at the next generation?

b) The answer is quite simple: the **net** rate of 1.00 supposes a **gross** rate of 1.024 if we consider a population of which 97.6% of the girls reach the mean age of motherhood (cf. V 1 c), proportion which corresponds to countries enjoying the best sanitary conditions. This means that 2.4% of the girls that are born will die before reaching the mean age of motherhood, that is to say a **gross** reproduction rate of:

$$\frac{100}{97.6} = \frac{1.00}{0.976} = 1.0245.$$

As we know that on 205 births, there are 100 girls, the *gross* reproduction rate of 1.0245 is expressed by a total fertility rate of 2.10 children for one woman, i.e.

$$1.0245 \times \frac{205}{100} = \mathbf{2.10}.$$

This same total fertility rate can also be obtained by dividing the *gross* reproduction rate by the female rate (cf. I 4 a). Indeed:

$$1.0245 \times \frac{1}{0.488} = \mathbf{2.10}.$$

So 100 women must have 210 children, i.e. a total fertility rate of 2.10 children per woman, or 210 children for 100 women.

c) A more detailed explanation:

There is a double question:

1. First we must know how many *girls* will need to have 100 women of a given "cohort" (cf. I 5 a) for these women to be replaced. Considering that when 100 girls are born, 97.6 will reach the mean age of motherhood (cf. V 1 c) against 2.4 who will die before this age, these 100 women need to have together 102.45 daughters or each one 1.0245 daughter, to be *reproduced* in the proportion of one *woman* for one *woman*. This is what is meant when it is asserted that the **gross** reproduction rate of 1.0245 is necessary for a **net** reproduction rate of 1.00 to be assured on countries enjoying the best sanitary conditions.
2. From this starting point, we can easily calculate the necessary total fertility rate for the *replacement of the population*. We must, therefore, know how many children women of a given "cohort" (cf. I 5 a) will need to have for the *population* to be *replaced*.
   How do we calculate this?
   Knowing that on 205 births, there are about 100 girls (cf. I 4), the total fertility rate, given x, indicating the number of children a woman must have for the replacement of the *population*, will be to 1.0245 in the same ratio of 205 to 100 (cf. II 3 b). So we have:

$$\frac{x}{1.0245} = \frac{205\ (105\ boys + 100\ girls)}{100\ (100\ girls)}$$

   Therefore:

$$x = \mathbf{2.10}.$$

   (x = the necessary total fertility rate to replace the population of a developed country).

3. In short, from point 1 to point 2, we go from the consideration of ***women*** who ***reproduce*** each other, to the consideration of the ***population*** (male and female) that is being ***replaced***.

d) PLEASE DO MIND! The 2.1 level of the total fertility rate is not sufficient at any time and at any place to secure the repalcement of the population.

1. The 2.4% female percentage of female dying before reaching the mean age of motherhood (cf. II 3 b; V 1 c) is low. As said before (cf. II 3 a-c), it corresponds to a country enjoying *very good sanitary conditions.*
2. *According to countries,* parastic diseases (among which malaria, cholera, tuberculosis), behaviour leading to death (such as drug addiction, suicide), AIDS (cf. VI 2 b), as well as mass-sterilization and provoked abortion, will definitely make a higher fertility rate of 2.1 necessary for the population to be replaced.
3. *In under-developed countries,* infant mortality (cf. VI 3) and that of girls before they reach the mean age of motherhood (cf. V 1 c) is very high. It can be higher even than 250‰ in several African countries. As a consequence, the necessary total fertility rate to replace the population must be about 3.00 children per woman, or even more.
4. According to the "World Population Reference Data Sheet (1994)" the total fertility rate was evaluated at 6.6 for West Africa; 6.4 for Central Africa; 6.5 for East Africa; 4.6 for Western Asia; 4.2 for South-Central Asia; 3.4 for South-East Asia; 1.9 for East Asia. In Central America, it would be of 3.5; in the Caribbeans, of 3.1; in South America, of 3.1. In China the rate would be of 2.0; in Taiwan of 1.7 and in South Corea of 1.6.
5. Considering all these factors, a few countries who, according to the "Population Reference Data Sheet (1994)", present a total fertility rate far superior to 2.1, are in fact scarcely able to reach the replacement level of their population, and are perhaps even below this level. *This fact is not always clearly brought out.* Mentioning the information of the "Population Reference Data Sheet (1994)" we want to draw the attention on a few Latin-American countries presenting the following situation:

Illustration 2

Total Fertility rate and Infant mortality rate

Country	IMR	TFR
Brazil	66	3.0
Colombia	33	2.7
Dominican Republic	43	3.3
Mexico	35	3.2
Honduras	50	5.2

IMR = Infant Mortality Rate for **1000** Births.

TFR = Total Fertility Rate (Number of children per woman).

Sources: Population Reference Bureau Data Sheet (1994).

6. *In developed countries,* this total rate of simple replacement (2.1) is actually never reached. According to *Eurostat* (1993), it was in the region of 1.51 for the European Community, of 1.62 for Belgium, 1.26 for Italy, 1.33 for Germany and Spain. For France, the annual assessment of the INSEE (1994) revealed that the total fertility rate had come down to 1.65, whereas *Eurostat* (ed. of 1993) mentioned it as being 1.78 in 1990. According to the "Population Reference Bureau Data Sheet (1994)" this rate is 2.1 for the USA; 1.8 for Canada; 1.5 for Japan. In ex-East Germany, it was 0.83 in 1992. The population is ageing and in certain countries it is not renewed.
7. It is assessed that *in 1800 or thereabouts,* the total fertility rate of countries that are developed nowadays, had then to be about 4.00 to secure the simple replacement because of the very high infant mortality rate (250 on 1,000) and next the also very high mortality rate (250 for 1,000) between the first anniversary and the mean age of motherhood (cf. V 1 c).
8. As a result of what has just been said, **one may not maintain without momentous restrictions that the total fertility rate of 2.1 is necessary to keep the population at the *zero population growth* [*Croissance zéro; Crecimiento cero de población*].** The level of the total fertility rate must indeed be higher in a region

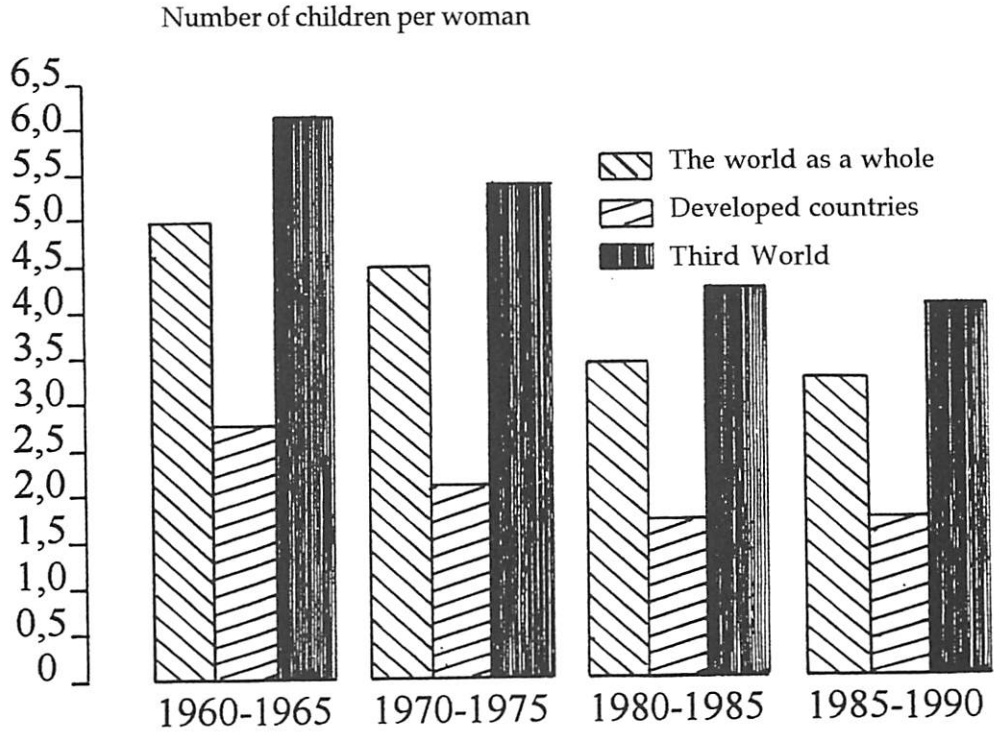
where mortality conditions and sanitary conditions are not at a very high level.

9. Supposing a maximum progress in policies and sanitary behaviour, and so without infant mortality, nor mortality until mean age of motherhood (cf. V 1 c), the *theoretical* limit for the replacement of the population should be a total fertility rate of 2.05. Indeed, on a total of 205 births, about 105 boys and 100 girls are born (cf. I 4).

e) Since 1960 the total fertility rate has gone down (sometimes very rapidly) almost everywhere in the world. *This fact is largely misappreciated and is not always clearly brought out* (cf. VII 5; see also V 1b). This phenomenon is exposed in the *World Population Monitoring, 1993,* published in 1994 by the UNO (see pp. 123-134; §§ 209-229). This fact appears in the following graphic.

Illustration 3

Evolution of the Total Fertility Rate in the World



Sources: after D. NOIN, p. 80.

4) Replacement rate

It is in fact the *net* reproduction rate (cf. II 2), which can be either equal, higher or lower to 1.

5) Population momentum [***Elan*** or ***potentiel démographique; Ímpetu demográfico***]

A population may go increasing in number in spite of the decrease of the total fertility rate, indeed even below this level. This phenomenon is called "population momentum". It is the result of what is called the "inertia" of demographic phenomena.

How can it be explained?

a) Let us consider a country whose population structure per age is young (cf. V 4). Let us suppose that women in procreation age are less fertile than their mothers. Taken as a whole, it may be that nevertheless they have more children because they are more numerous. Mothers have less children, but there are more mothers.

b) This higher number may be the result of two causes:

1. These young women are descended from generations with a relatively higher fertility.
2. Moreover, their mortality rate is lower than their mother's.

6) Overplus of births [***Excédent des naissances; Excedente de nacimientos***]

In *industrial countries,* in spite of a very low fertility rate (cf. II 3 d 4), one can often observe an overplus of births against deaths.

How can it be explained?
The answer is simple:

a) In these countries, there are for example boys and girls who died *before they were one year old,* because scarcely 70 years ago infant mortality was 10 times higher than today (cf. II 3 d 5; VI 3). Others died as a result of wars (cf. Illustration 4).

b) Among those who survived, many of them were not able to benefit from the constant progress of medicine. So they died *before reaching the age one could hope to attain in our days* on the grounds of a general increase of life expectancy (cf. VI 1).

c) Those in some sort *"anticipated"* deaths give the ***false*** impression of an excess of births against deaths. But if all the people born for instance in 1914 had reached the age of 75 (life expectancy nowadays in rich countries) i.e. until 1989, the deaths would exceed births today in these same countries.

CHAPTER III

THE "FALSE FRIENDS"

Confusions are frequent between diverse indicators, but nevertheless very different.

1) Crude birth rate [*Taux de natalité; Tasa de natalidad*]

It is expressed in the ratio between the births reckoned in one year and the number of inhabitants of a given territory. It gives the birth number on 1,000 inhabitants.

This rate is less significant than the *general fertility rate* (cf. below, III 2), and thus also than the *total fertility rate* (cf. II 1); this is because the *whole* population, female as well as male, of all ages, of a specific territory, intervenes in the reckoning of this rate. So its level depends on the composition per age and sex.

2) General fertility rate [*Taux de fécondité générale; Tasa general de fecundidad*]

It is expressed in the ratio between births reckoned in one year and the number of women in age of procreation, living in a specific territory. Although it may be more significant than the crude birth rate (cf. above, III 1), it is *less precise* than the *total fertility rate* (cf. II 1). The difference between the two is explained here below (cf. III 3).

3) Risks of confusion

A few publications wrongly omit to distinguish clearly between the *total fertility rate* (cf. II 1) and the *general fertility rate* (cf. III 2). The first allows to measure and to compare with precision the fertility behaviour. The second

does not allow this, for it depends on the composition per age of the given population (cf. V 4).

4) Completed fertility rate [*Descendance finale d'une génération, Tasa final de fecundidad*]

It is the ratio between the number of children issued from one given generation and the number of women of this generation. This ratio expresses thus the *definitive fertility* of one generation.

The complete fertility rate expresses the average number of children women of one same generation have had at the conclusion of their fertile life, i.e. before 50 years. Consequently, it can only definitely be calculated when a generation has reached this age. Thus it is applied to one specific generation, and not to the population as a whole.

This is what is known as a *lengthwise* or *longitudinal* measure, or a *period analysis*, i.e. concerning a long period (cf. II 1) [*Analyse longitudinale; Análisis en un período*].

5) Natural balance [*Solde naturel; Saldo natural*]

It is the difference between birth rate and death rate for one given year. It can be positive (which is the case for the majority of countries on the planet in 1994), or negative (for example in Russia, Hungary, Bulgaria, Ukraine, Estonia, Latvia, Germany in 1992).

6) Rate of natural increase [*Taux d'accroissement naturel; Tasa de aumento natural*]

For one given year, it is the ratio between the natural balance (difference between birth and death rates; cf. above, III 5) and the mean population of this year. It is expressed in the mean population percentage and is calculated as follows for the "Costa Brava" Republic (invented example):

$$\frac{762{,}023\,(births) - 680{,}325\,(deaths)}{59{,}269{,}974\,(mean\ population)} = \frac{81{,}698}{59{,}269{,}974} = 0.001378$$

That is to say 0.14% (rounded off).

The *mean population* is calculated in a simplified manner by dividing by 2 the amount of population at the beginning of the year and at the end of the year.

7) Growth rate [*Taux d'accroissement annuel total d'une population; Tasa de crecimiento*]

It measures the general movement of a given population by adding the *natural increase rate* (cf. above III 6) to the *increasing rate due to migration* (cf. IV). It is expressed by the mean population percentage of the year (cf. III 6). It can be either positive or negative.

a) This rate is calculated as follows for the Kingdom of "Parateca" (invented):

$$\frac{683{,}229 - 598{,}435 + 18{,}071}{44{,}837{,}592} = 0.0022941$$

That is to say 0.23% (rounded off)

In this formula 683,229 corresponds to births; 598,435 to deaths; 18,071 to migration saldo, positive in this case; 44,837,592 is the mean population.

b) A rate of +2% would mean that on 100 inhabitants, one would pass, from one year to another, from 100 to 102 inhabitants. A rate of –2% would mean to pass from 100 to 98 inhabitants.

c) The *growth rate* must not be **mistaken** with the *crude birth rate* (cf. III 1).

CHAPTER IV

MIGRATIONS

1) By **internal migration**, we mean the movement of people inside the territory of one same country. By **international migration**, we mean the crossing of a border to move to another country.

2) **Net migration** [***Solde migratoire; Migración neta***] is, for one given year, the difference between the number of persons who have emigrated from a country, i.e. who have stopped living there, and the number of persons who have immigrated towards this same country, i.e. who have settled there.

CHAPTER V

POPULATION STRUCTURE

1) Mean age [*Age moyen; Edad media*]

It is the average age, by and large, of all the individuals of one given population. It is the total sum of all the years lived by the individuals of one given population divided by the number of these individuals.

a) It is calculated as follows:
Example: In Hotel "Bornival" (invented), at a given date, there were:

30 persons aged 17 years who total	510 years
26 persons aged 30 years who total	780 years
39 persons aged 38 years who total	1482 years
47 persons aged 60 years who total	2820 years
142 persons who total	5592 years

The mean age is 5592 : 142 = *40 years* at this given date.

b) Female mean age at marriage tends to rise almost everywhere. This rise has a negative effect on fertility. According to the "Population Reference Bureau", this age has passed from 20 to 22 between 1950 and 1980 in Latin America. According to *Eurostat* (1993), it was 26.9 in 1990 for the European Community.

c) The **mean age of motherhood** can, in particular, be calculated by adding the ages of women who, in one year, gave birth to a child, in one specific area. The sum is divided by the number of women. In developing

countries, this mean age is sometimes about 22 years; in industrialized countries, it rises to 28-30 years.

2) Median age [*Age médian; Edad mediano*]

It is the age which divides one given population into two equal parts, the first constituted by those who have not yet reached this age, the other by those who are over this age. Median age is thus the value situated at 50% of the series of data.

How is this calculated?

Example: The Town Council of the city of Faena (invented) is composed of 11 members, who are respectively 38, 39, 43, 47, 48, 51, 53, 56, 57, 62, 65 years old. The median age of the members of this Council is 51 years, i.e. the number of Councillors who are not yet 51 is equal to those who are over this age.

The median age rises when fertility goes down and/or when life gets longer: it is the *ageing* of population, i.e. the increasing proportion of elderly people and correlative decrease of young people.

The **confusion** tends to be frequent between *mean age* and *median age*. The mean age of a population may be very high, if it is attracted by some high values, or it can be very low, if these values draw it downwards. As a matter of fact, the reality is better expressed by the *median* age.

3) Age-dependency ratio [*Rapport de dépendance; Razón de dependencia por edad*]

It expresses the ratio between "depending" persons and the other persons. "Depending" persons are generally defined as those under 15 and more than 64 in Southern countries; those under 20 and more than 64 in industrial countries.

The study of the population pyramid (cf. below V 4) will help to understand the importance of this ratio.

4) Population pyramid [*Pyramides des âges; Pirámide de población*]

a) It is a very enlightening graphical representation of the distribution of the population per age and per sex, considered at one given moment, for example on the day of the census of the population. It represents the structure of the population per age and per sex.

Here is for example a recent demographic "photography" of Europe of the Twelve.

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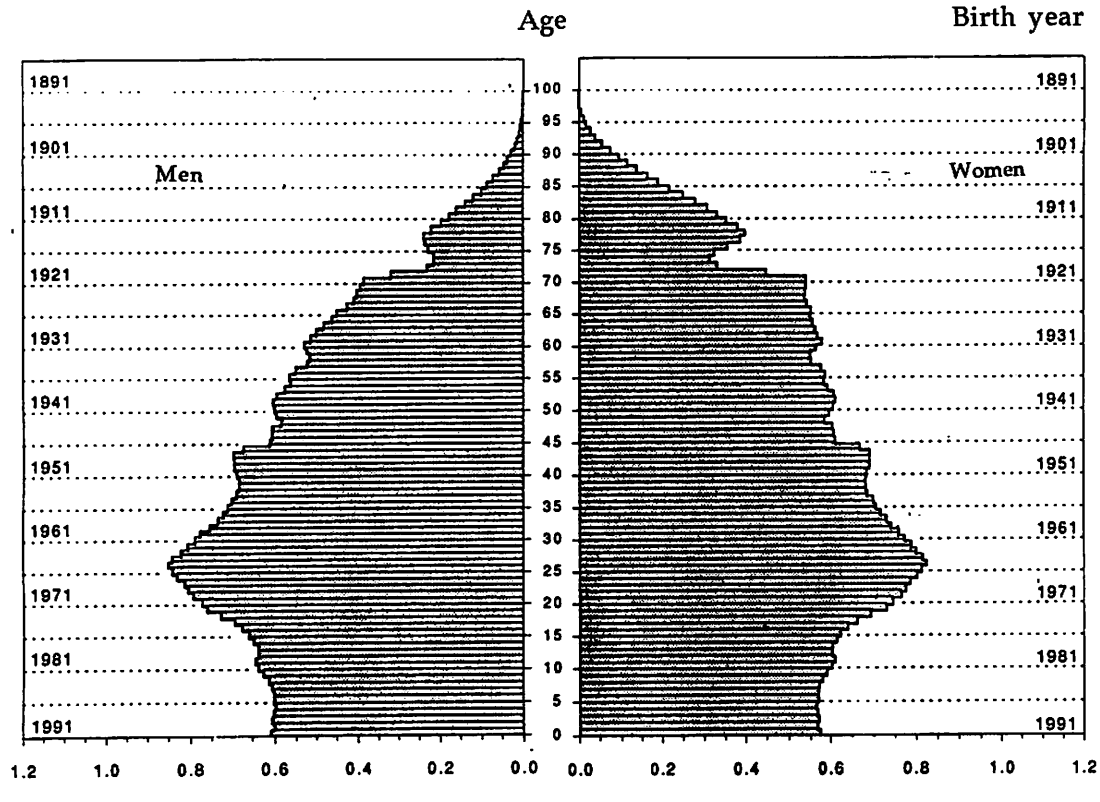

in % of the total population

The effect of the 1914-1918 war appears, in particular for men, at the level of the population aged ± 75 years; that of the 1939-1945 war at the level of the population aged ± 50 years.

Source: *Eurostat* (1993), p. 29.

b) "Pyramids" can take diverse shapes, as these ones:

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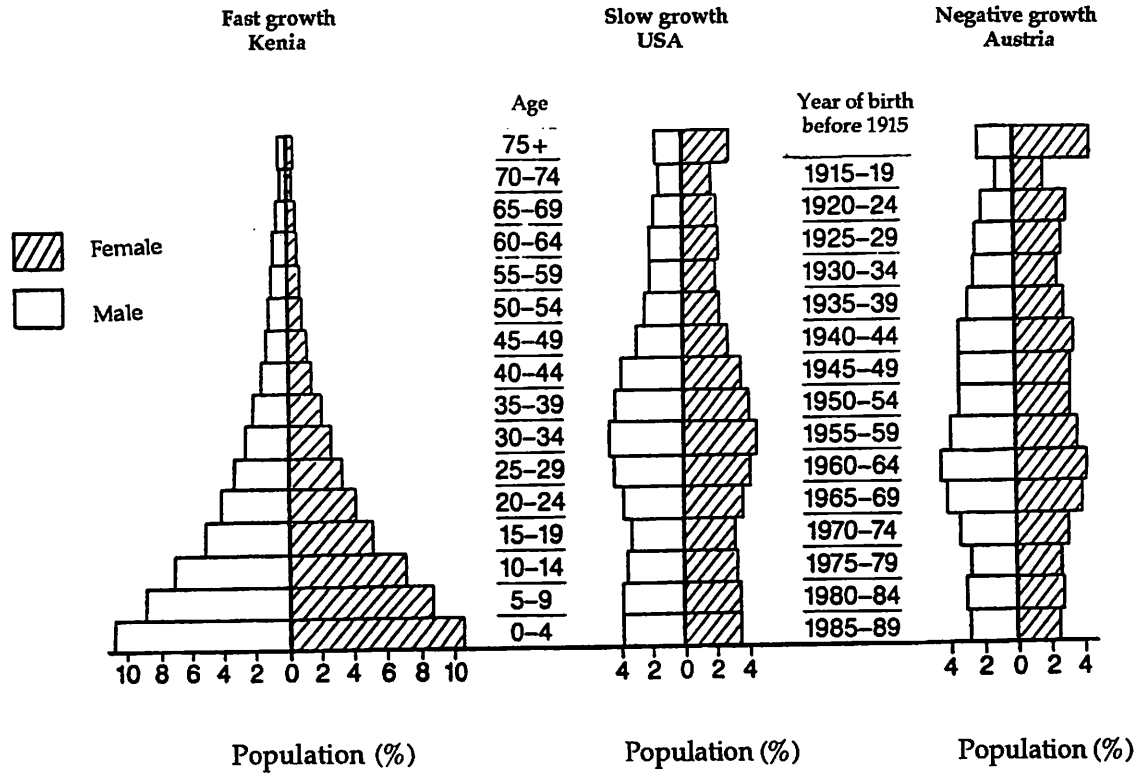
Three Examples of Population Pyramids



The different surfaces area of the rectangles represents, in each group of 5 years, the population percentage of each of these groups in regard to the total population.

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c) Although it may be a photography of the state of a population at one given time, yet a "pyramid" gives us information as to the *demographic history* of this population. It teaches, for example, about the existence of generations less numerous as a result of wars. For example, this narrowing appears clearly on illustration 4, above, concerning the 1914-1918 and 1939-1945 wars.

Moreover they teach *with certainty future prospects.* Indeed, *in the absence of any migration,* it is simply impossible for the effective of population of any age bracket to increase on the pyramid; the effective of each age bracket is represented by a rectangular surface which can in no way get wider and which on the contrary can only decrease, as each age bracket is affected by a certain mortality rate.

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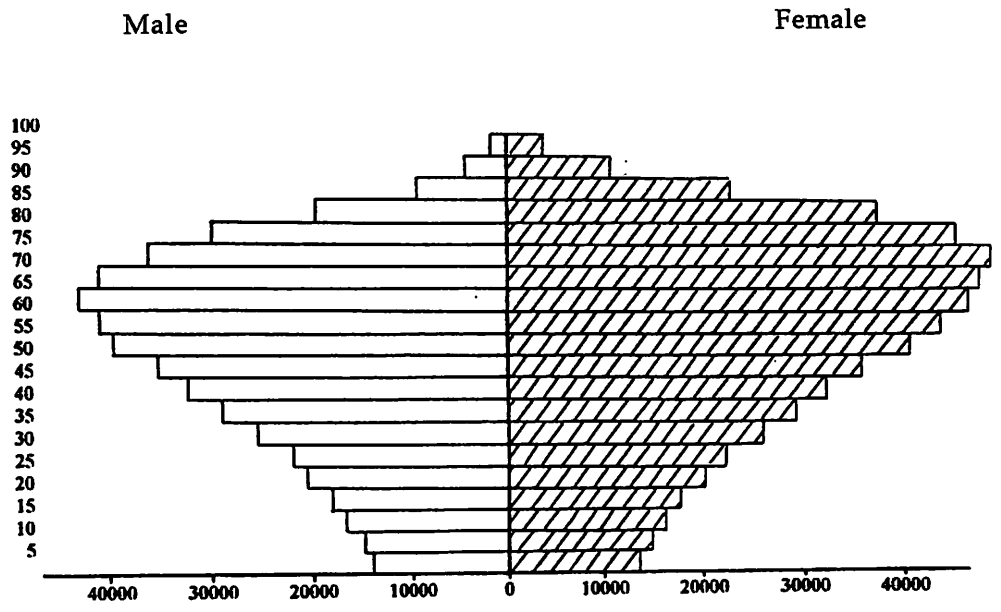

In this pyramid, the number of inhabitants by group of age is represented according to the scale indicated at the absciss.

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CHAPTER VI

MORTALITY

1) Life expectancy at birth [*Espérance de vie à la naissance; Esperanza de vida al nacer*]

It is the estimation of the mean number of years a new-born may hope to live in a specific region, if the mortality rate per age (cf. below VI 2) is identical to that of his birth year. This is called a transversal measure (cf. II 1).

a) In Europe, until the XVIIIth century, the life expectancy at birth was lower than 40 years, and sometimes 30 years. Nowadays, life expectancy is rising almost everywhere, even in Southern countries, with the exception of regions in Africa most affected by AIDS. *It is one of the best indicators of development level.*

b) The general rising of life expectancy at birth is due first and foremost to the progress in medicine (asepsis, vaccination, etc.), of hygiene, as well as of the progressive improvement of the conditions of life (cf. VII 5). Among others, this progress has brought about the fall of *infant mortality* (cf. VI 3), as well as *youth* and *maternal* mortality.

c) Life expectancy at birth must not be **confused** with mean age (cf. V 1), nor with median age (cf. V 2).

2) Death rate [*Taux de mortalité; Tasa de mortalidad*]

It is the ratio of deaths in one year and in a specific territory, to the average number of inhabitants of this same territory. It expresses the death rate per 1,000 inhabitants.

a) This rate is *often higher in rich countries* than in poor countries. Why? As the age pyramids show (cf. V 4), the proportion of old people is generally higher in rich countries than in poor countries.

Examples: According to the "Population Refrence Bureau Data Sheet (1994)", the mortality rate is assessed at 10‰ for the whole world, 10‰ for developed countries and 9‰ for developing countries. It is estimated at 7‰ for the whole of Latin America; at 8‰ for Asia; at 11‰ for Europe and 13‰ for Africa.

b) One expects that in certain countries, the mortality rate will be more and more influenced by *AIDS* and its consequences in the development of other illnesses.

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CHAPTER VII

THE "DEMOGRAPHIC TRANSITION"

1) This expression has been made up to define the *passage* of one demographic situation characterized by a high mortality rate *and* a high birth rate to a demographic regime characterized by a low death rate *and* a low birth rate.

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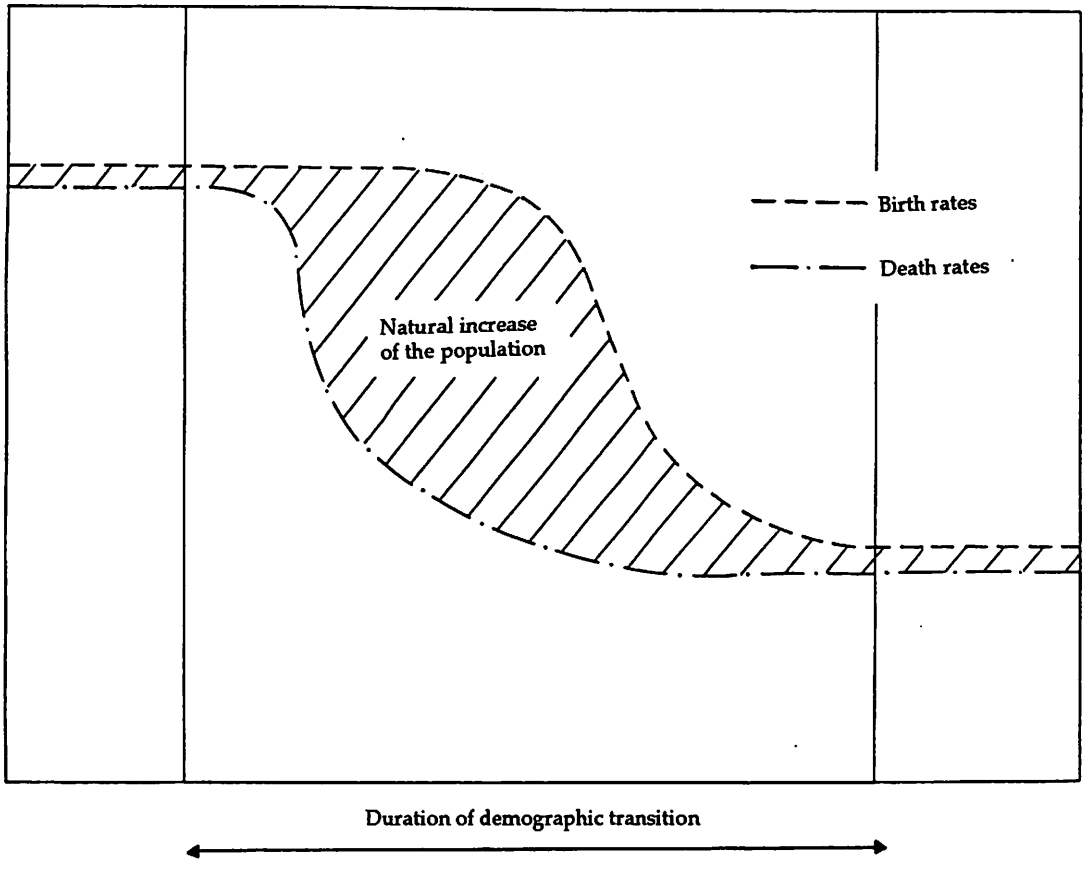

The population, with births and deaths is represented in ordinate, duration in abscissa.

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2) This passage or this *transition* has lasted for more than two centuries in countries that are developed nowadays; it was achieved or is presently achieving much quicker in the Third-World countries, as death and birth rate are much lower there.

3) At *first* this transition is essentially marked by a fall of the death rate and *secondly* by a drop of birth rate. Now, as the drop of death rate precedes that of birth, there is a sustained increase of population during the transition period. The speed of the transition in Southern countries explains the importance of the rate of natural increase at the beginning of the transition.

4) The scheme of demographic transition has taken and still takes very different shapes according to the countries. According to this generally observed scheme, *economic, social, medical and sanitary development* brings about a fall of death rate followed by a fall of birth rate.

5) The scheme allows to understand the *demographic increase of the Northern countries in the XIXth century and of Third-World countries in the XXth century*. This increase is due to the speedy fall of mortality, even and mainly infant and maternal mortality (cf. VI 2 and 3). Especially in the Third-World, this fall was the result of the spread, on a large scale, of very effective medical care, generalizing, for example, the use of vaccination and hygiene. Men get older and older (cf. VI 1) and are therefore more numerous to occupy the earth *at the same time.*

As a matter of fact, demographic growth has not been due and is not to be attributed to an increase of fertility, which is *decreasing* everywhere (cf. II 3 e), but to the fall of mortality, which leads to an increase of life expectancy (cf. II 5-6; VI 1 a b). *These last facts are not always clearly brought out.*

6) The *initial* demographic situation, i.e. prior to the transition, can be observed and assessed. However it is not the same for the demographic situation *posterior* to this transition. At that moment, nothing can guarantee for example, that the mortality rate will not start afresh increasing, for instance either because of wars or epidemics as it is already the case in several regions of black Africa, or because of ideological failures as in certain East-European countries. Neither does anything guarantee that the fertility rate will stop declining.

CHAPTER VIII

TOTALLY RELATIVE CONCEPTS

1) Has the formula "carrying capacity of earth" any meaning? [*Capacité porteuse de la terre; Capacidad portadora*]

It is the supposed capacity of the earth to accommodate a predetermined amount of individuals. This concept is *totally relative.*

a) According to certain authors who *generalize* the central thesis of Malthus (cf. IX 1) — and for all that, this thesis is refuted by facts — the resources of the earth would be *definitively* limited whereas the population could grow *indefinitely.* Hence the alarm about what some call "population explosion". Yet this expression is wrong, for it underestimates or even ignores as well the scheme of demographic transition as the logic of demographic mechanisms.

Moreover, the increase of population depends on the use of sufficient food means. Otherwise the mortality rate would rise and reduce the number of people (cf. VI).

The case of *Latin America* is exemplary. In spite of its carefully worked out system, the pre-columbian society was able to feed only a few millions of its inhabitants. Now, according to the "Population Reference Bureau Data Sheet (1994)", Latin American counts 470 millions inhabitants.

b) History shows that the "carrying capacity" is totally relative to the way man uses his intelligence and his will. This "carrying capacity" *does not stop evolving,* thanks to man's intelligence and intervention.

c) *Examples*:

1. The Indians in Texas have for centuries lived on *oil* deposits. It's only by the intervention of man that this oil has become a resource.
2. Malthus (cf. IX 1) has underestimated the possible part of man in the improvement of *agricultural productivity*. This is due, in particular, to the progress of organic chemistry.
3. *Silica*, more commonly known as *sand*, was quite an ordinary matter until a few years ago. It became a prodigious resource from the moment men used it in electronics and to make optic fibres. These have revolutionized techniques of medical diagnosis and telecommunications.
4. The *cryotechniques*, or techniques using low temperature, have in a spectacular way reduced the transport and storage expenses for perishable goods such as fruit and meat.
5. Numberless other examples could be mentioned: *titanium*, a very abundant element, has been used for about fifty years, in composite materials, aerospace industry, surgical prothesis; *wind* has been exploited by the Dutch for centuries to develop the polders; the exploitation of *solar energy* has but just been started.
6. Conversely, elements that were formerly considered as important natural resources, are considered as less and less interesting. This explains why some raw materials have become so cheap. *Example*: copper is more and more replaced by optic fibre for telecommunication (cf. above VIII 1 c 3).

d) In short, thanks to intellectual and moral education, and with political will properly advised, men are capable of accepting the challenge arising from environment. Without twisting the paradox of this expression, one could eventually say that *"man is the sole true resource for man"*. It is him in the first place and foremost who must be brought out; thanks to him things *will become* resources and will acquire value.

2) Has the ever used term of "overpopulation" any meaning?

For reasons deriving from what has been said, the term "overpopulation" has no absolute meaning and is also *totally relative*.

a) People are deemed as "too numerous" when they are unable to solve food, hygienic and other problems. Now there are always possible *remedies* to these situations; these situations can be *avoided.*

b) What some call *overpopulation* is the imbalance between the number of men and the bulk of available goods. However one must notice that what is called *poverty* is also imbalance between the number of men and the bulk of available goods. In fact the expression "overpopulation" has become *a pejorative term to designate poverty.* Now many territories are at the same time poor, with low population, and yet dispose of important resources badly exploited. When a situation is looked at in terms of "overpopulation", the heart tends to harden. When the situation is looked at from the angle of "poverty", it makes people inclined to compassion, help and solidarity.

c) Today, less than ever, *poverty* must not be defined firstly in material terms. It is man's reason and will that transform *things* into *resources.* Therefore poverty must first be defined in human terms: it results from the incapacity of certain men, often submitted to ill-fated policies, to exploit the whole of their intellectual and moral potential in order to solve their problems.

d) In *Japan,* a country little favoured by nature and listed among the under-developed countries in the 50ties, has developed mainly thanks to the systematic and unprecedented investments in the formation of its most precious capacity: man.

e) Today, especially in the domain of food, one cannot go on considering that *production* problems come first, as did Malthus. The problems asking for an urgent solution are those of *distribution.* This means that they are dependent upon the will of man.

f) And so the necessity and urgency of *generalised education,* i.e. sharing of knowledge and know-how, is confirmed. But this education must equally comprise a moral facet: awareness to the exigencies of *social justice* and *solidarity.*

CHAPTER III

THE "FALSE FRIENDS"

Confusions are frequent between diverse indicators, but nevertheless very different.

1) Crude birth rate [*Taux de natalité; Tasa de natalidad*]

It is expressed in the ratio between the births reckoned in one year and the number of inhabitants of a given territory. It gives the birth number on 1,000 inhabitants.

This rate is less significant than the *general fertility rate* (cf. below, III 2), and thus also than the *total fertility rate* (cf. II 1); this is because the *whole* population, female as well as male, of all ages, of a specific territory, intervenes in the reckoning of this rate. So its level depends on the composition per age and sex.

2) General fertility rate [*Taux de fécondité générale; Tasa general de fecundidad*]

It is expressed in the ratio between births reckoned in one year and the number of women in age of procreation, living in a specific territory. Although it may be more significant than the crude birth rate (cf. above, III 1), it is *less precise* than the *total fertility rate* (cf. II 1). The difference between the two is explained here below (cf. III 3).

3) Risks of confusion

A few publications wrongly omit to distinguish clearly between the *total fertility rate* (cf. II 1) and the *general fertility rate* (cf. III 2). The first allows to measure and to compare with precision the fertility behaviour. The second

does not allow this, for it depends on the composition per age of the given population (cf. V 4).

4) Completed fertility rate [*Descendance finale d'une génération, Tasa final de fecundidad*]

It is the ratio between the number of children issued from one given generation and the number of women of this generation. This ratio expresses thus the *definitive fertility* of one generation.

The complete fertility rate expresses the average number of children women of one same generation have had at the conclusion of their fertile life, i.e. before 50 years. Consequently, it can only definitely be calculated when a generation has reached this age. Thus it is applied to one specific generation, and not to the population as a whole.

This is what is known as a *lengthwise* or *longitudinal* measure, or a *period analysis*, i.e. concerning a long period (cf. II 1) [*Analyse longitudinale; Análisis en un período*].

5) Natural balance [*Solde naturel; Saldo natural*]

It is the difference between birth rate and death rate for one given year. It can be positive (which is the case for the majority of countries on the planet in 1994), or negative (for example in Russia, Hungary, Bulgaria, Ukraine, Estonia, Latvia, Germany in 1992).

6) Rate of natural increase [*Taux d'accroissement naturel; Tasa de aumento natural*]

For one given year, it is the ratio between the natural balance (difference between birth and death rates; cf. above, III 5) and the mean population of this year. It is expressed in the mean population percentage and is calculated as follows for the "Costa Brava" Republic (invented example):

$$\frac{762{,}023\,(births) - 680{,}325\,(deaths)}{59{,}269{,}974\,(mean\ population)} = \frac{81{,}698}{59{,}269{,}974} = 0.001378$$

That is to say 0.14% (rounded off).

The *mean population* is calculated in a simplified manner by dividing by 2 the amount of population at the beginning of the year and at the end of the year.

7) Growth rate [*Taux d'accroissement annuel total d'une population; Tasa de crecimiento*]

It measures the general movement of a given population by adding the *natural increase rate* (cf. above III 6) to the *increasing rate due to migration* (cf. IV). It is expressed by the mean population percentage of the year (cf. III 6). It can be either positive or negative.

a) This rate is calculated as follows for the Kingdom of "Parateca" (invented):

$$\frac{683{,}229 - 598{,}435 + 18{,}071}{44{,}837{,}592} = 0.0022941$$

That is to say 0.23% (rounded off)

In this formula 683,229 corresponds to births; 598,435 to deaths; 18,071 to migration saldo, positive in this case; 44,837,592 is the mean population.

b) A rate of +2% would mean that on 100 inhabitants, one would pass, from one year to another, from 100 to 102 inhabitants. A rate of –2% would mean to pass from 100 to 98 inhabitants.

c) The *growth rate* must not be **mistaken** with the *crude birth rate* (cf. III 1).

CHAPTER IV

MIGRATIONS

1) By **internal migration**, we mean the movement of people inside the territory of one same country. By **international migration**, we mean the crossing of a border to move to another country.

2) **Net migration** [***Solde migratoire; Migración neta***] is, for one given year, the difference between the number of persons who have emigrated from a country, i.e. who have stopped living there, and the number of persons who have immigrated towards this same country, i.e. who have settled there.

CHAPTER V

POPULATION STRUCTURE

1) Mean age [*Age moyen; Edad media*]

It is the average age, by and large, of all the individuals of one given population. It is the total sum of all the years lived by the individuals of one given population divided by the number of these individuals.

a) It is calculated as follows:
Example: In Hotel "Bornival" (invented), at a given date, there were:

30 persons aged 17 years who total	510 years
26 persons aged 30 years who total	780 years
39 persons aged 38 years who total	1482 years
47 persons aged 60 years who total	2820 years
142 persons who total	5592 years

The mean age is 5592 : 142 = *40 years* at this given date.

b) Female mean age at marriage tends to rise almost everywhere. This rise has a negative effect on fertility. According to the "Population Reference Bureau", this age has passed from 20 to 22 between 1950 and 1980 in Latin America. According to *Eurostat* (1993), it was 26.9 in 1990 for the European Community.

c) The **mean age of motherhood** can, in particular, be calculated by adding the ages of women who, in one year, gave birth to a child, in one specific area. The sum is divided by the number of women. In developing

countries, this mean age is sometimes about 22 years; in industrialized countries, it rises to 28-30 years.

2) Median age [*Age médian; Edad mediano*]

It is the age which divides one given population into two equal parts, the first constituted by those who have not yet reached this age, the other by those who are over this age. Median age is thus the value situated at 50% of the series of data.

How is this calculated?

Example: The Town Council of the city of Faena (invented) is composed of 11 members, who are respectively 38, 39, 43, 47, 48, 51, 53, 56, 57, 62, 65 years old. The median age of the members of this Council is 51 years, i.e. the number of Councillors who are not yet 51 is equal to those who are over this age.

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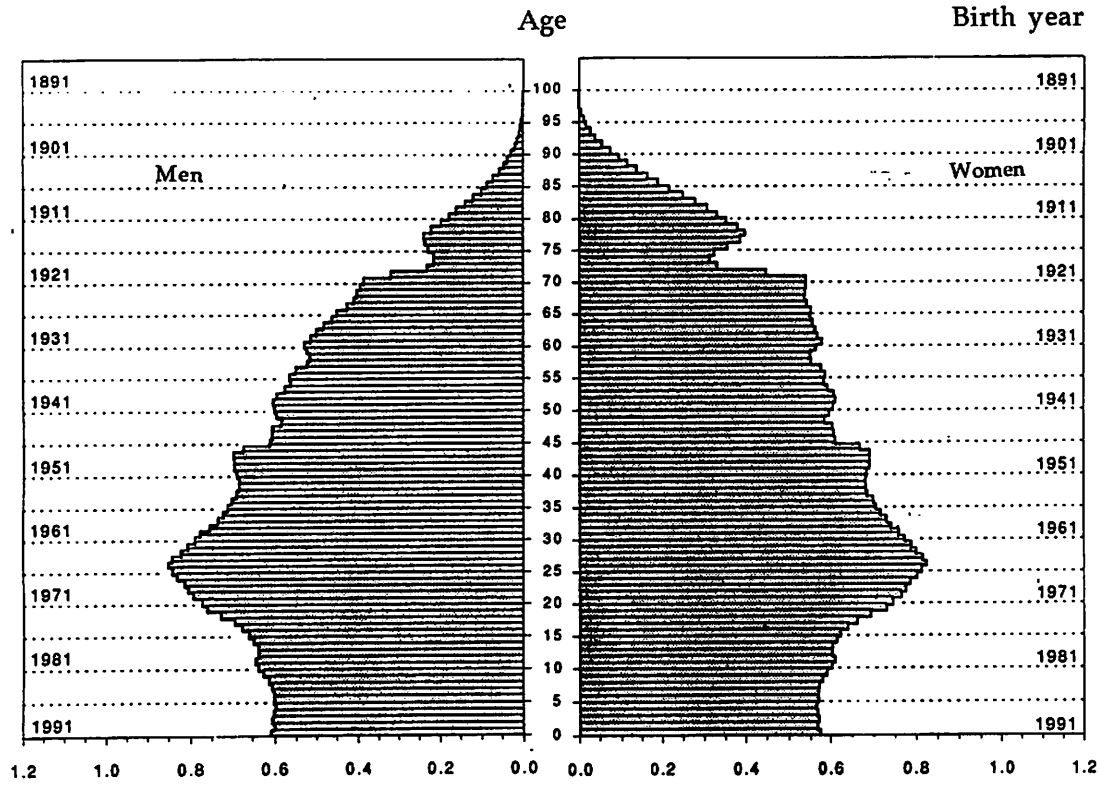

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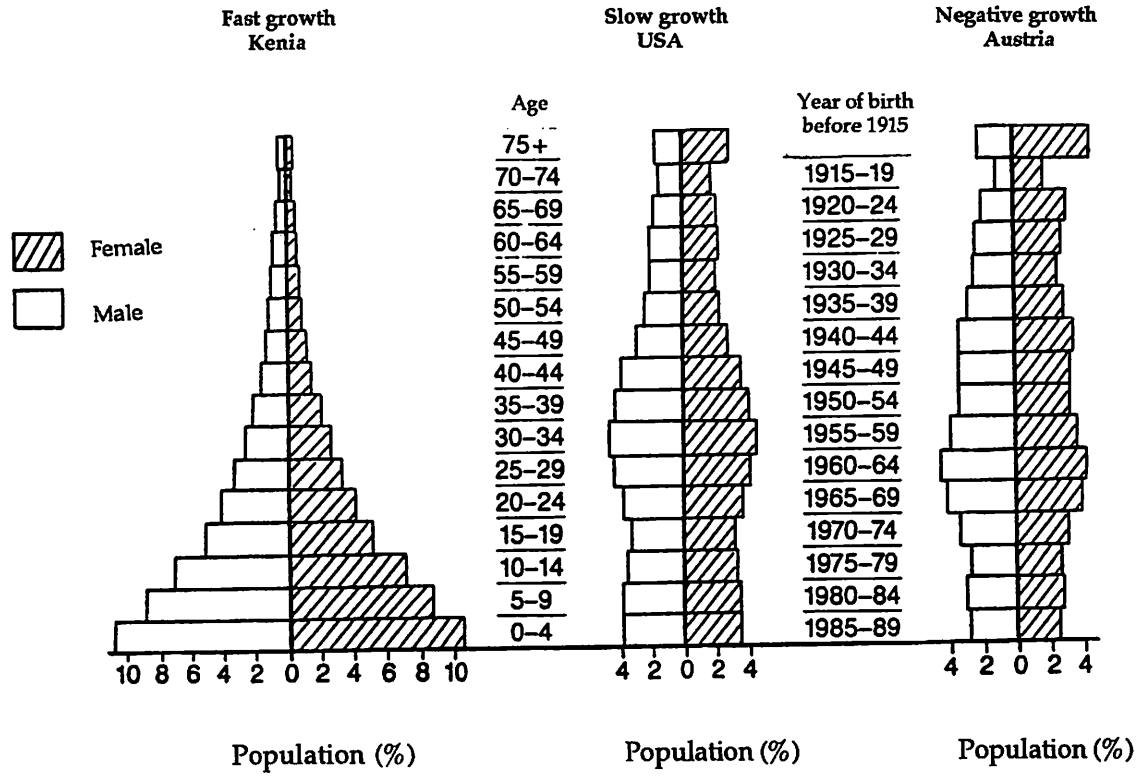

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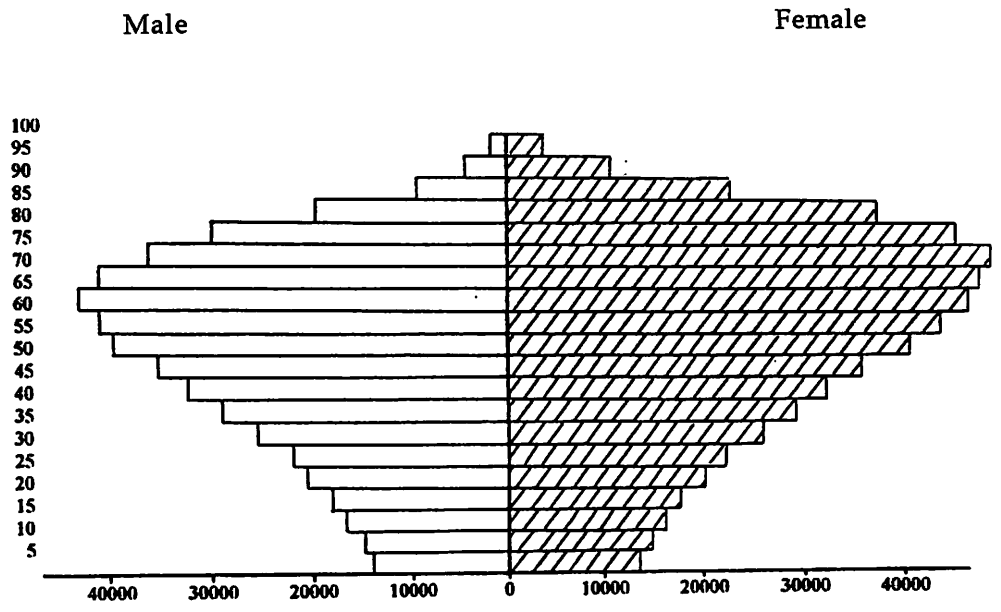

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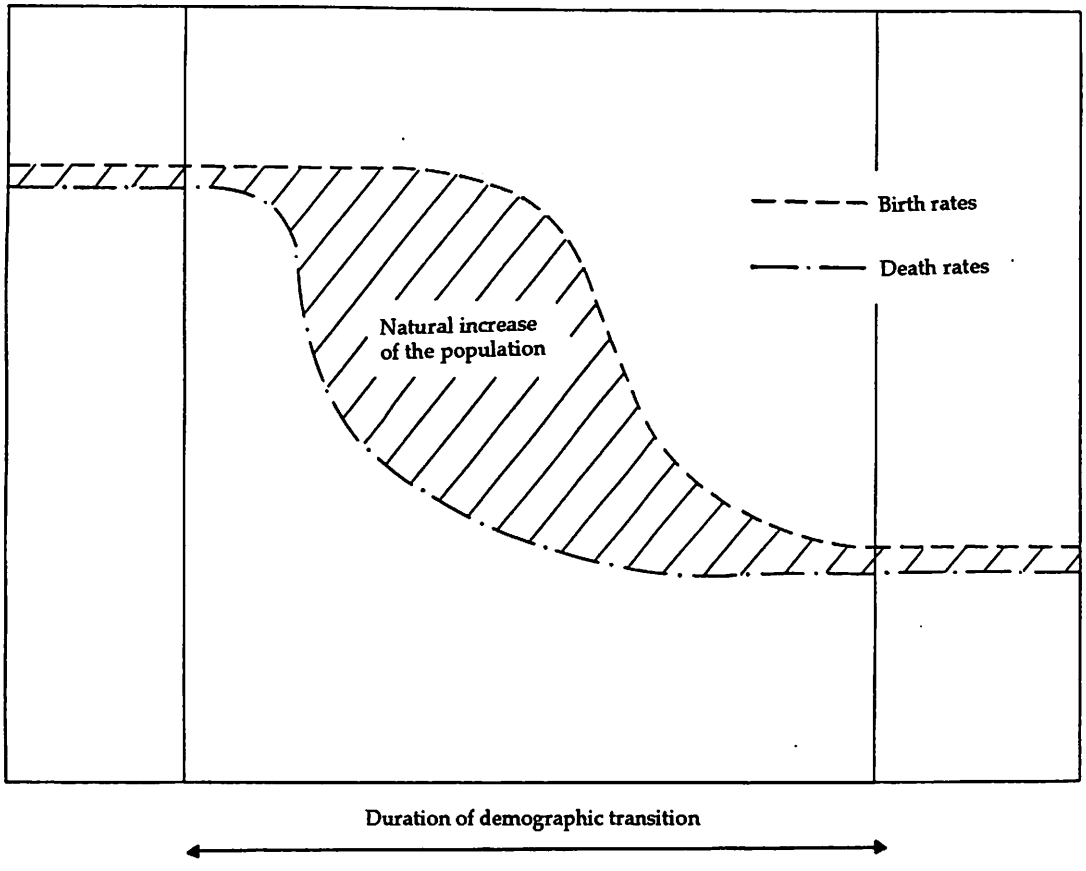

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4) The scheme of demographic transition has taken and still takes very different shapes according to the countries. According to this generally observed scheme, *economic, social, medical and sanitary development* brings about a fall of death rate followed by a fall of birth rate.

5) The scheme allows to understand the *demographic increase of the Northern countries in the XIXth century and of Third-World countries in the XXth century*. This increase is due to the speedy fall of mortality, even and mainly infant and maternal mortality (cf. VI 2 and 3). Especially in the Third-World, this fall was the result of the spread, on a large scale, of very effective medical care, generalizing, for example, the use of vaccination and hygiene. Men get older and older (cf. VI 1) and are therefore more numerous to occupy the earth *at the same time.*

As a matter of fact, demographic growth has not been due and is not to be attributed to an increase of fertility, which is *decreasing* everywhere (cf. II 3 e), but to the fall of mortality, which leads to an increase of life expectancy (cf. II 5-6; VI 1 a b). *These last facts are not always clearly brought out.*

6) The *initial* demographic situation, i.e. prior to the transition, can be observed and assessed. However it is not the same for the demographic situation *posterior* to this transition. At that moment, nothing can guarantee for example, that the mortality rate will not start afresh increasing, for instance either because of wars or epidemics as it is already the case in several regions of black Africa, or because of ideological failures as in certain East-European countries. Neither does anything guarantee that the fertility rate will stop declining.

CHAPTER VIII

TOTALLY RELATIVE CONCEPTS

1) Has the formula "carrying capacity of earth" any meaning? [*Capacité porteuse de la terre; Capacidad portadora*]

It is the supposed capacity of the earth to accommodate a predetermined amount of individuals. This concept is *totally relative.*

a) According to certain authors who *generalize* the central thesis of Malthus (cf. IX 1) — and for all that, this thesis is refuted by facts — the resources of the earth would be *definitively* limited whereas the population could grow *indefinitely.* Hence the alarm about what some call "population explosion". Yet this expression is wrong, for it underestimates or even ignores as well the scheme of demographic transition as the logic of demographic mechanisms.

Moreover, the increase of population depends on the use of sufficient food means. Otherwise the mortality rate would rise and reduce the number of people (cf. VI).

The case of *Latin America* is exemplary. In spite of its carefully worked out system, the pre-columbian society was able to feed only a few millions of its inhabitants. Now, according to the "Population Reference Bureau Data Sheet (1994)", Latin American counts 470 millions inhabitants.

b) History shows that the "carrying capacity" is totally relative to the way man uses his intelligence and his will. This "carrying capacity" *does not stop evolving,* thanks to man's intelligence and intervention.

c) *Examples*:

1. The Indians in Texas have for centuries lived on *oil* deposits. It's only by the intervention of man that this oil has become a resource.
2. Malthus (cf. IX 1) has underestimated the possible part of man in the improvement of *agricultural productivity*. This is due, in particular, to the progress of organic chemistry.
3. *Silica*, more commonly known as *sand*, was quite an ordinary matter until a few years ago. It became a prodigious resource from the moment men used it in electronics and to make optic fibres. These have revolutionized techniques of medical diagnosis and telecommunications.
4. The *cryotechniques*, or techniques using low temperature, have in a spectacular way reduced the transport and storage expenses for perishable goods such as fruit and meat.
5. Numberless other examples could be mentioned: *titanium*, a very abundant element, has been used for about fifty years, in composite materials, aerospace industry, surgical prothesis; *wind* has been exploited by the Dutch for centuries to develop the polders; the exploitation of *solar energy* has but just been started.
6. Conversely, elements that were formerly considered as important natural resources, are considered as less and less interesting. This explains why some raw materials have become so cheap. *Example*: copper is more and more replaced by optic fibre for telecommunication (cf. above VIII 1 c 3).

d) In short, thanks to intellectual and moral education, and with political will properly advised, men are capable of accepting the challenge arising from environment. Without twisting the paradox of this expression, one could eventually say that *"man is the sole true resource for man"*. It is him in the first place and foremost who must be brought out; thanks to him things *will become* resources and will acquire value.

2) Has the ever used term of "overpopulation" any meaning?

For reasons deriving from what has been said, the term "overpopulation" has no absolute meaning and is also *totally relative*.

a) People are deemed as "too numerous" when they are unable to solve food, hygienic and other problems. Now there are always possible *remedies* to these situations; these situations can be *avoided.*

b) What some call *overpopulation* is the imbalance between the number of men and the bulk of available goods. However one must notice that what is called *poverty* is also imbalance between the number of men and the bulk of available goods. In fact the expression "overpopulation" has become *a pejorative term to designate poverty.* Now many territories are at the same time poor, with low population, and yet dispose of important resources badly exploited. When a situation is looked at in terms of "overpopulation", the heart tends to harden. When the situation is looked at from the angle of "poverty", it makes people inclined to compassion, help and solidarity.

c) Today, less than ever, *poverty* must not be defined firstly in material terms. It is man's reason and will that transform *things* into *resources.* Therefore poverty must first be defined in human terms: it results from the incapacity of certain men, often submitted to ill-fated policies, to exploit the whole of their intellectual and moral potential in order to solve their problems.

d) In *Japan,* a country little favoured by nature and listed among the under-developed countries in the 50ties, has developed mainly thanks to the systematic and unprecedented investments in the formation of its most precious capacity: man.

e) Today, especially in the domain of food, one cannot go on considering that *production* problems come first, as did Malthus. The problems asking for an urgent solution are those of *distribution.* This means that they are dependent upon the will of man.

f) And so the necessity and urgency of *generalised education,* i.e. sharing of knowledge and know-how, is confirmed. But this education must equally comprise a moral facet: awareness to the exigencies of *social justice* and *solidarity.*