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Calculating Age Without Asking for it

Method of Estimating the Age and Age-Structure of the Fula Bande (Eastern Senegal)

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CALCULATING AGE WITHOUT ASKING FOR IT

Method of Estimating the Age and Age-Structure of the Fula Bande (Eastern Senegal)

Introduction

In countries where vital registration is non-existent or insufficient, age-estimation represents an important problem. The wav it is treated varies with the type of survey, the size of the population observed and the means available, but in all cases age remains imprecise, and sometimes very much so. This general imprecision would not affect our analyses too much, were it not aggravated in most cases by systematic errors concerning certain age groups. Various methods have been proposed [1] for correcting these biases in the age-structures, but they must be used prudently : apart from some rare exceptions [5, 11], we know very little about these biases, and are totally incapable of measuring them.

Faced with this problem in our study of the Fula Bande in Eastern Senegal (1), we have applied an indirect method, in order to obtain individual ages as near reality as possible, but also and above all to suppress the biases traditionally observed by dealing with their cause : the drawbacks of human memory for measuring length of time.

It should be mentioned that vital registration was initiated in this area in 1950, but is practically non-existent : the few births registered are almost all from the village where the registration office is situated, and are moreover unreliable.

Before presenting our method in detail, we must introduce the population observed, as certain aspects of its social organisation have directly inspired it.

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(1) Monography of a small traditional population, study co-financed by CNRS (Population Dynamics Programme), ORSTOM and INED.

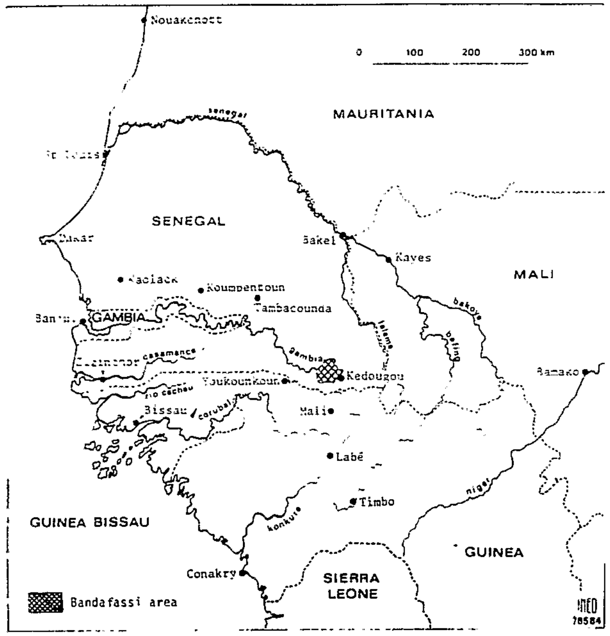

Figure 1. — Situation of the Bandafassi Area in West Africa.

The Fula Bande are a small group — currently just over 3 600 — of sedentary, islamized Fula inhabiting, with two other ethnic groups, the Bedik and the Niokholo Mandenka, the area of Bandafassi in Eastern Senegal (Figure 1). They belong to the vast Fula family which extends all over Western Africa south of the Sahara, and their culture and history relates them more particularly to the Fula of Fouta Djallon (Guinea) [3, 4].

The population lives in compounds, each one including the members of an extended patrilineal family. These compounds are grouped into 21 villages, with an average population of just under 200 inhabitants in about 10 compounds.

Unlike the neighbouring animists, the Bedik Banapas or Mandenka, the Fula Bande have no kind of system based on age-groups. They only recognize one major event modifying the social status of an individual : his entry into adult life, upon circumcision for males, when they are initiated, and upon marriage for females.

Circumcision, which is performed roughly around 15 years of age (this will be discussed later), is a very important festival for the Fula Bande. It usually takes place at the same period, in February or March, every 3 or 4 years, but this may be modified by the year's harvest — the parents must provide huge quantities of food — or the size of the village, and thence the number of candidates.

Together, all the candidates in the village go through a certain number of "tests" lasting several weeks, which form their "initiation". Unlike the non-islamized Bedik or Mandenka, for whom the actual operation — performed several years earlier by a nurse at the local dispensary — is completely dissociated from the festival, the Fula Bande nearly always have circumcision performed in the traditional manner during the actual festival. After the operation, the youths are banished from the village for a long period until their wounds are completely healed. The fact of sharing the initiation tests and living together during this post-circumcision period creates strong bonds among the youths, who will never forget the names of their "fellow-circumcised".

We should mention that the young girls also have an excision operation, which gives rise to festivities often grouped with circumcision. This does not, however, mark as strong a change in social status as circumcision, as it is performed earlier, around 8-10 years of age.

Excision groups have not been used in our method of estimating age, as information was more difficult to obtain, and less reliable. As the survey was made by a male, interviewing mainly other males, and therefore much better informed about male social life, much more reliable information could be obtained about circumcision than about excision groups.

I. — The Method of Estimating Age

A. — Our principle : make the most of human memory

When no vital registration exists, direct estimation of age consists of estimating the length of time between a birth and the present moment. It is completely different from the straightforward substraction involved when we dispose of dates. In this latter case, human memory is asked to provide two dates, a date of birth and the present date; in the former, it is asked for a length of time.

As we live in a world where every event has its date, it is difficult to imagine measuring time without these dates. A study of the errors in age declared may enlighten us on the possible deviations between real time and estimated time when no registration exists. In our survey on this subject [11], which concerns the under-15s, we observed a general tendency towards under-estimation as of age 4, increasing with age to reach a mean under-estimation of over 2 years at age 14.

If human memory is somewhat unreliable where duration is concerned, it is much more trustworthy for giving an order of events.

The "historical calendar" method [12] of estimating age is based on this faculty of the human memory for remembering the order in which events happened : it is concerned with placing an individual's birth within a series of dated events obtained from written records. Unfortunately, the events found in these records are rarely the ones people remember best, as they were not always directly concerned by them, and this method therefore often gives disappointing results. But if we ask people to classify the important events happening in their own village — births, deaths, circumcisions, excisions — much better results are obtained, as they are personally concerned.

To avoid the problems of bias affecting certain age-groups when people are questioned directly about their age, we have attempted to estimate age by using only information on the order of events, completely leaving aside all information on length of time. The events we have considered are births and circumcision festivals.

B. — *Our data : two types of classification*

The surveys carried out over the past few years among the Fula Bande have provided a very reliable population register. The census conducted in February 1975 has been followed by a multiround survey, which brings the register up to date regularly every year. The number of errors — omissions, double counts — is therefore greatly reduced by this repetition. Moreover, a complete genealogical survey has further enabled a certain number of omissions, especially concerning old women, to be detected.

This population register has enabled us to make out individual cards giving a certain amount of information for identification and other purposes : family name, first name and nickname, sex, parents' names, village of residence, name of head of compound. The village of birth is also marked, as well as an approximate age-group; this is not really an exception to our rule about not using any data on age declared, as we do not in fact use this information for calculation : it is merely an indication used to facilitate the first type of classification.

1. — Classification of births

Classifying the population of a village by birth-rank is a method which has been proposed several times in the past for determining age when no vital registration is available, but is has rarely been applied in practice [6, 7, 8].

It is based on the fact that everyone in a village knows everyone else. The older members of the village are, in most cases, able to say which of two inhabitants was born first. The information gathered is, however, only reliable if the village is small in size and if both inhabitants were born in the same village.

This second condition means that if the method is applied independently to each village within a survey area, it loses a great deal of its interest, as mobility may be high between villages, particularly for women when the virilocal rule is observed. In Patrick Gubry's survey in Cameroon, 21 % of men and 53 % of women were born outside the village studied [6], and could not therefore be classified.

This problem is easily resolved when the survey covers all the villages in an area, simply by classifying the inhabitants by village of birth instead of village of residence [8]. This method reduced the proportion of our non-classable individuals to those born outside the survey area : 8 % of men and 10 % of women.

In practice, the individual cards are classed for each village as follows : one or several old men are chosen to answer the questions: taking the first two individual cards, we ask who is the elder of the two inhabitants; then, taking a third card, we compare it with one of the first two, asking the same question, then with the other if necessary; and so on until all the cards have been presented.

As the multi-round survey was in its third year when we started this classification, we have not classed children under 3 years of age. The tedious, repetitive nature of the interview led us to break it up as much as possible, on the one hand by proceeding in stages, separating the sexes, then interclassifying them, and on the other hand by dividing the larger villages into hamlets; in any case, the information becomes less reliable when the villages are too large, as "everyone knows everyone else" no longer applies.

On the other hand, when the observation units are too small, or in the case of some older age-groups, too empty, they are not interesting either. Smaller villages were therefore grouped together prior to classification, as were in some cases the older members of several villages.

In all, we obtained 23 "classification units" (hamlet, village, group of villages) with an average of 150 inhabitants (see App. fig. 1).

How reliable is this classification by birth rank ?

Two observations may throw some light on this question :

- There are few cases where classification is impossible : A older than B, C older than A and C younger than B. As the person interviewed answers "in the dark", with no prior knowledge of the classification already made, we may therefore say that, in the vast majority of cases, the answers are coherent with one another.

- Individuals who were double-counted had two individual cards, often under different names, for themselves and for their parents. There were similarly cases of twins not identified as such. The classification by birth-rank enabled a certain number of these cards to be coupled, thus revealing the presence of double-counting or twins.

In some cases, the two cards, which had been classified independently (whether double-counts or twins not recognized as such) did not follow one another, but they were never more than 1,2 or 3 places away.

Evidently, these tests of internal coherency do not prove that the order established through birth-rank classification corresponds exactly with the real order, but errors are slight.

Experience has proved that the main problems related to this method concern the identification of the individual by the people interviewed. The use of nicknames, when known, avoids identification errors due to the fact that many individuals may have the same name.

Classification by birth-rank may therefore furnish reliable information. Its application to large-scale surveys involving an important survey team is, however, very difficult.

2. — Classification of circumcision groups

The classification of a population by birth-rank provides relative ages; to obtain absolute ages, we turned to a second type of chronological classification, concerning circumcision groups.

Circumcision groups, identified by members' names, were listed in chronological order for each village, going back to the earliest circumcision group the villagers could remember, even, when possible, those with no living member (see App. fig. 2). Then we asked, for each group, whether there had been other circumcision groups the same year in the nearest 4 or 5 villages. If so, we asked for the names of their members. If not, we asked whether such or such a circumcision group in neighbouring villages had its festival before or after the group concerned. We were thus able to interclassify circumcision groups for several neighbouring villages, gradually classing the whole of the survey area in this way (388 circumcision groups). Unlike birth-rank classification, several groups may occupy the same rank : all those circumcised the same year.

This information is relatively easy to obtain, as the members have keen memories of everything concerning their circumcision. The few cases of incoherency observed could often be dealt with very simply, as there were several sources of information concerning each group : if one source is in contradiction with 4 or 5 others, then the chances are that it is erroneous.

We were thus able to obtain another relative chronology. An absolute chronology, that is, actual circumcision dates, was obtained relatively easily by the following process : we observed that circumcision festivals were held in 52 different years for at least one of the villages concerned; as circumcision usually takes place around 15 years of age, and assuming few men live to over 80, we can see that each rank in our classification corresponds roughly to one of the last 65 years, the slight difference being due to the fact that there are some years where no circumcision was performed in any of the villages.

Events related to the French colonization have been very useful for establishing an absolute chronology of the circumcision years. The

population observed counts several ex-servicemen who conserve their draft papers with great care. As they were already circumcised when drafted into the army, the dates on their draft papers set a minimum for their circumcision year. Moreover, we were able to interview them about which villagers were or were not circumcised when they left for the army, and about who was circumcised in the year they left and in the year they returned. We were thus able to date each of the circumcision years.

The information obtained for the population born in one of the villages studied (over 90 % of the total population) is therefore : birth-rank within the classification unit, for all, and circumcision year, for all circumcised males. A detailed example is given in Appendixed table 1, where the (living) population of a small village is classed by birth-rank, for all those born in the village, with indication of circumcision years.

These data coupled with various assumptions concerning mean age at circumcision form the basis of our computations. Appendixed table 1 shows estimates obtained for our small village example, under assumption 3 as defined below.

C. — Computation : assumptions and models

Our estimation centres on the age at which each circumcised male was circumcised. We thus compute the age of these males, and then, by interpolation, the age of the non-circumcised population.

Various assumptions and models are involved :

1. — Mean age at circumcision within a circumcision group

The age at which parents decide to have their son circumcised depends on customs and practices which may vary from one family to another, and from one village to another. Climatic conditions, affecting the harvest, and the demographic situation — abundance or shortage of male youths — may also advance or delay a village's circumcision festival, by as much as several years in the case of severe weather conditions.

It is moreover very risky for outsiders, even after attending the actual festival, to try and guess at the age of circumcision candidates.

We are therefore obliged to assume there exists a *mean age at circumcision* applicable to the whole survey area, and try to estimate this age and the variations around it by means of the information we have obtained from various reliable sources.

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The first stage consists of allotting a value to mean age at circumcision. There are several indications that this age has considerably decreased over the last generation or two :

— The age at circumcision we have been able to estimate empirically for certain individuals, through various cross-checking, varies between 16-18 years in the older cases and 13-15 years for the younger ones.

— The village elders say that at one time it was not uncommon for fathers to give their sons a wife shortly after circumcision, and an ex-serviceman told us he was recruited just a year after he was circumcised.

These various empiric estimations and the information forwarded, whatever its actual value, all tend to indicate that age at circumcision has decreased over the past few decades. Our assumptions take this into account.

The next stage is to estimate the variations around this mean age at circumcision for the various groups.

A first source of information is the number of years between two circumcision festivals. If this lapse of time is long, we may suppose that either the second festival has been delayed or the first one advanced, and the contrary if it is short. We have therefore adopted the following model for computing the mean age at circumcision for a group n :

Given A_{n-1}, A_n and A_{n+1}, the circumcision years for three successive groups, $n-1$ being the youngest group, and AC the overall mean age at circumcision, which we assume we know.

AC_n, the mean age at circumcision for group n is expressed by the relationship :

$$AC_n = AC + \frac{1}{2} \times A_n - \frac{1}{4} \times A_{n-1} - \frac{1}{4} \times A_{n+1}$$

2. — Distribution of the age at circumcision within a circumcision group

We have chosen a linear distribution in terms of birth-rank within the group. The two extremes, that is, the ages of the oldest and youngest members, have been computed so that the youngest member of group n is older than the oldest member of group n.

Globally, if E_n is the total of all living members of group n, the year of birth $AN_{i,n}$ of the ith. member (the first member being the youngest one) is computed as follows :

$$AN_{i,n} = \frac{1}{2}(A_{n-1} + A_n) + \frac{1}{2E_n}\left(i - \frac{1}{2}\right)(A_{n+1} - A_{n-1}) - AC$$

3. — Distribution of the ages of the non-circumcised population

We must distinguish between adult females and children, male or female, younger than the youngest circumcised male.

The age of an adult female can necessarily be situated, through birth-rank classification, between the ages of two circumcised males. We can therefore compute her age by linear interpolation between the ages of these two males, in accordance with birth classification.

For the children aged between 3 and 11-15 (approximate age of the youngest circumcised male) a linear distribution model is unrealistic as it supposes, inter alia, that mortality is negligible between these two ages. Now, the annual death rates observed in 1963-66 for the Serer in the Sine Saloum area of Senegal vary between 50 p. 1000 at 3-5 years, 10 p. 1000 at 5-10 years and 5 p. 1000 at 10-15 years [2]. To allow for the high mortality observed at ages 3 and 4, we therefore distributed the children in two fractions, in the following proportions : $(5 - 3) \times 6$ for those aged 3 or 4, and $(a - 5) \times 5$ for the remainder, those aged between 5 and a, a being the age of the youngest circumcised male. This somewhat arbitrary method has finally made little difference to the ages as computed by straightforward linear interpolation, since the values 6 and 5 of the weights are very close.

We encountered certain practical problems, the most important of which were :

- Overlapping between successive circumcision groups : when a member of group n is classed as younger than a member of group $n - 1$. After calculation within each group, the ages allotted to these overlapping members were inverted in order to respect birth-rank classification.
- Computation of the ages of very old women : at the end of the table, certain old women cannot be classed between two men, since women are, as we shall observe later, more numerous than men at the higher ages. For these women, we could only estimate a minimum age, that of the oldest male, which is why we have classed them separately for the age-structures.

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With only a classification of the population by birth-rank and a classification of circumcision groups to work on, by formulating mainly linear models for age-distribution and introducing two assumptions, one on mean age at circumcision and the other on an absolute chronology of circumcisions, we were thus able to obtain an estimated age for every individual born in the village.

We used the basic classifications available in a very different way from Patrick Gubry in his Cameroon survey [6], where they served for correcting ages obtained mainly by the historical calendar method; this has the drawback of leaving intact the biases traditionally observed for certain age-groups, in particular those affecting both sexes.

The method we have adopted here, very close to the one used for studying the neighbouring Mandenka [8], eliminates a priori the biases related to errors in the age declared. It may create new ones, in particular if our hypotheses are false or highly unrealistic. If this is the case, can these biases be detected, and then corrected by modifying the various assumptions we have introduced ? The second part of this paper, where we present our results, throws some light on this question.

II. — The Results : The Age-Structure of the Fula Bande

A. — A first attempt : assumption 1 For our first computation, we adopted the assumption — which was, in view of our information, a priori unrealistic — of an invariable mean age at circumcision, 16 years : this was a straightforward "first go".

The resulting age-structure of the population at March 1st 1979 is illustrated in Figure 2 by a population pyramid by individual years of age. The first 4 age-groups represent children born after the 1975 census, for whom, through the survey, we know the real age to a month.

The pyramid shows strong variations from one age to another, related to the small size of the population (3,623 individuals), which mask the general outline of the pyramid. We therefore formed quinquennial groups, which provided us with two population pyramids : on one hand, a pyramid by 5-year age-groups, and on the other, a fictitious pyramid by individual years of age, obtained by means of 5-year moving averages (Figure 3). This smoothing of the pyramid by individual years eliminates the strong annual variations while conserving the pluri-annual variations, which it renders more visible.

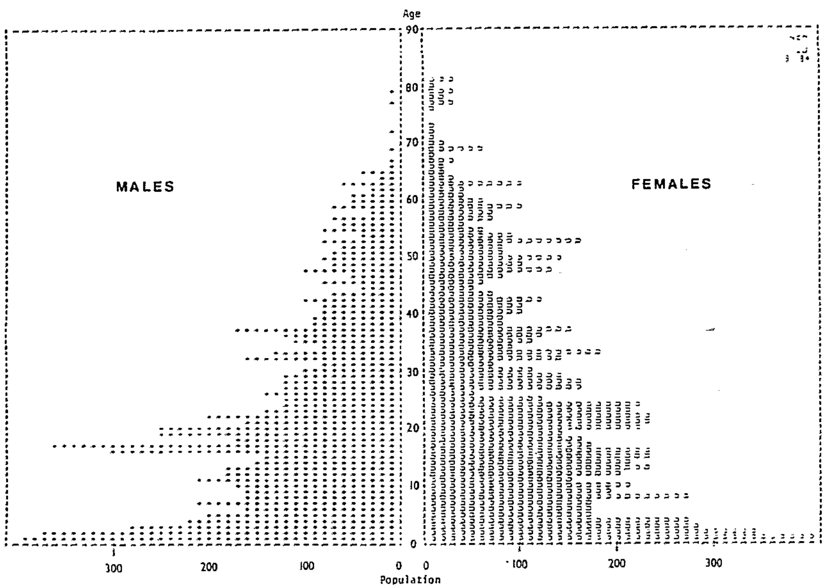

Figure 2. — Population pyramid by individual years of age, March 1st 1979. Assumption 1

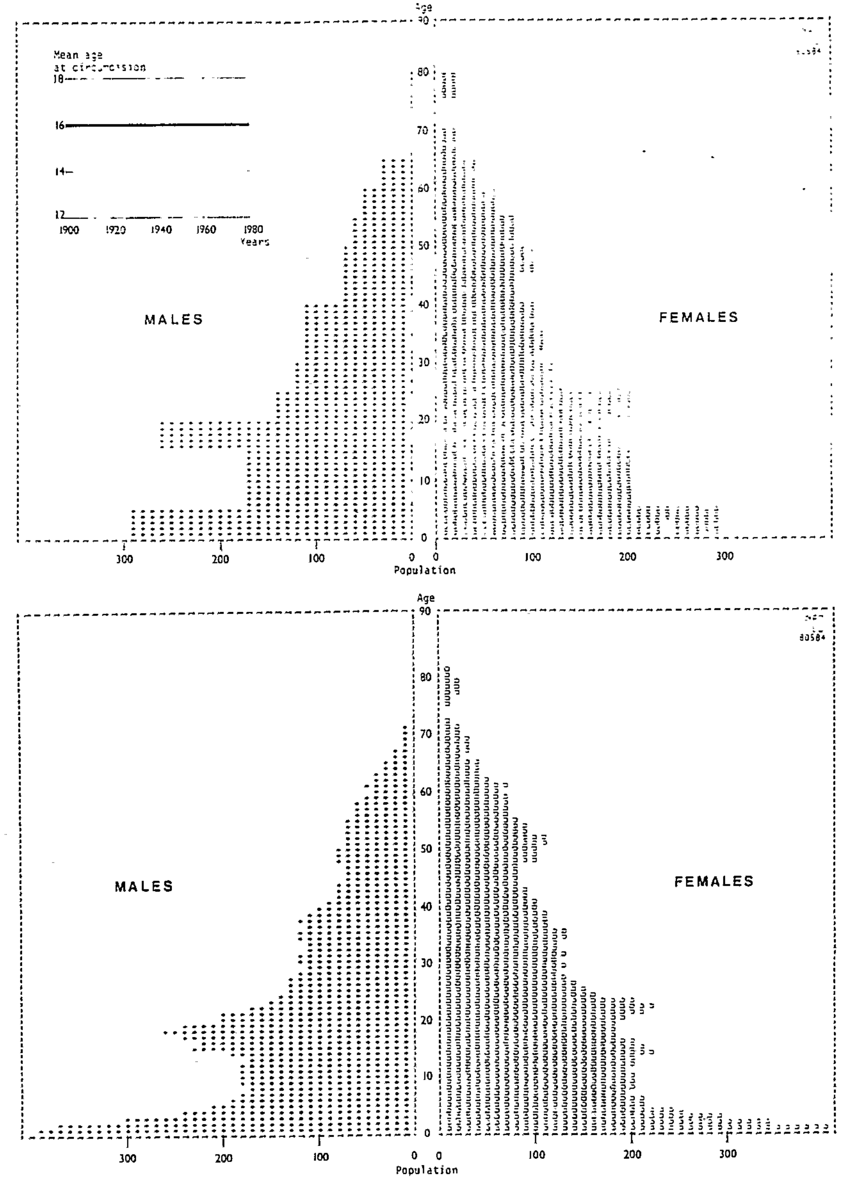

Figure 3. — Population pyramids by quinquennial age-groups and by smoothed individual years of age, March 1st 1979, Assumption 1

A rapid glance at Figures 2 and 3 reveals a marked irregularity, for both sexes, at ages 5 to 20. For males, in particular, the quinquennial pyramid (Figure 3) shows a deficit at age 5-9 years and an excess at age 15-19. The distortion is less clear-cut for females, and tends to be more spread out between 5 and 25 years.

The most simple explanation for this irregularity is a general over-estimation between ages 5 and 20-25 years. As the ages computed are globally related to our assumption concerning the mean age at circumcision, we concluded that our estimation was too high for these age-groups.

This first computation, based on an assumption concerning mean age at circumcision which was plausible in itself, but not consistent with the information we had, was carried out in order to show, not only how sensitive age-structure is to the various assumptions involved in computation, but in particular how errors in these assumptions may be detected, and thus corrected.

B. — A first improvement : assumption 2

In our second assumption, we introduced a mean age at circumcision set at 16 years until 1950, then decreasing regularly down to 13 years in 1980. 1950 is a somewhat arbitrary choice, but it corresponds roughly with the opening of the first schools and dispensary in the area.

The resulting age-structure is illustrated by the two population pyramids in Figure 6. Not surprisingly, they have a much more regular outline : our new assumption almost completely eliminates the irregularities observed in the first age-structure.

To test our estimation, we computed the resulting ages of mothers at childbirth. We considered only the births registered during the multi-round survey, therefore those we could date to a month. We studied the distribution of these births according to mother's age, paying particular attention to the youngest age-groups. For a total of 700 births, the number of births by biennial age-groups is as follows : 4 at age 11-12, 28 at age 13-14, 78 at age 15-16, 95 at age 17-18, then slowly decreasing to around age 50. Such surprisingly early motherhood could be partly accounted for by the very early marriage observed for women. Moreover, our estimates retain a degree of incertitude resulting from the method of computation, which may be estimated at + 1 or − 1 for these age-groups.

But, even allowing for this incertitude, such an early fertility pattern does not seem to fit in very well with other information we have on fertility in these populations. For instance, a survey conducted by Sylvie Epelboin on married women in one of the villages studied indicates that over 80 % had not arrived at puberty when they were married (unpublished information). Now, the rare data existing on puberty in rural Black Africa seems to indicate a fairly high age at puberty for these populations, 16 or more on average. Therefore early marriage does not necessarily mean early motherhood.

This suggested under-estimation of the mothers' age at childbirth, at least for the youngest age-groups. We therefore decided to modify the mean age at circumcision retained for 1980, 13 years, and replace it by age 14 for our next attempt, assumption 3.

But this modification should logically provoke, inter alia, a decrease in the 5-9 age-group, part of which would pass into the next group. As a deficit already appears in the 5-9 age-group under assumption 2, how are we to account for the even deeper deficit which will appear under assumption 3 ? Could there be other reasons than a bias related to our method of estimation ?

1970 to 1973 were years of severe drought affecting not only the stockbreeding areas of the Sahel, but more or less all of Western Africa. The annual rainfall observed (Figure 4) at the Kedougou weather centre, which has been running regularly since 1922 (apart from 1958-61), shows that 1972, the year of strongest drought, came at the end of an already very dry period lasting from 1967 to 1973. André Langaney has studied the effects of this drought on the Niokholonko population in our survey area

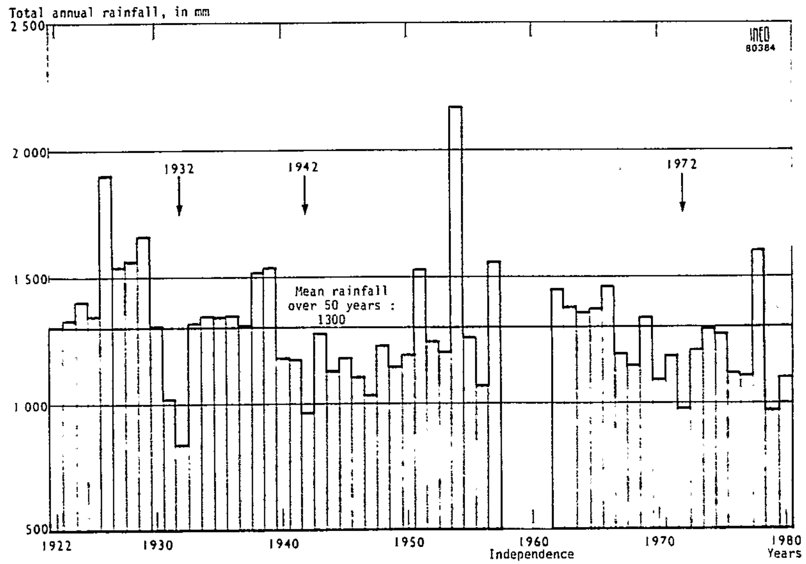

Figure 4. — Variations in total annual rainfall observed at Kedougou between 1922 and 1978

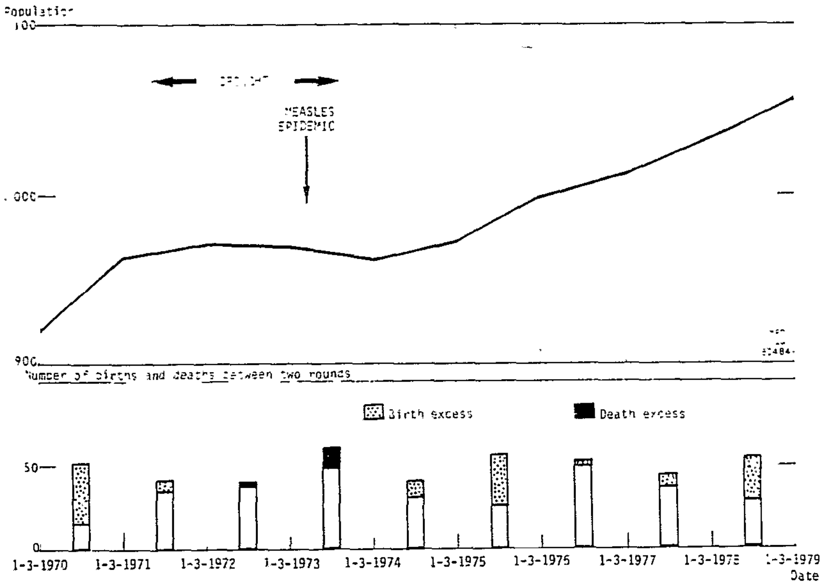

Figure 5. — Population movement in 6 Niokholonko villages between 1970 and 1979 (A. Langaney — *ref.* 9)

[9]. The multi-round survey he has conducted every year since 1970 among this population has permitted him to observe annual fluctuations (Figure 5). A natural increase of 1 % per annum was registered for the whole of the 8-year observation period, with zero increase in 1972 and a decrease in 1973, mainly due to a high increase in child mortality : a measles epidemic, in particular, caused many deaths in the villages in May-June 1973. Whether the drought actually favoured the development of the epidemic or not is unimportant : what is certain is that its devastating effects were multiplied by the population's poor diet at the time. Young children in the Fula Bande villages must also have been particularly affected by this high mortality, which could explain a deficit in the 5-9 age-group.

We must now consider another deficit — around age 43, for both sexes — which, already visible with assumption 1, becomes particularly pronounced at age 40-44 in the quinquennial pyramid obtained under assumption 2.

We thought at first that this deficit was due to our choice of a mean age at circumcision which, constant up to 1950, then decreasing all of a sudden after this date, resulted in a compression within the age-scale of those circumcised prior to 1950 (therefore aged 45 and over in 1979) and on the contrary a spreading-out of those circumcised after 1950 (aged under 45 in 1979). But this effect due to the model chosen, which we have tried to eliminate with our next assumptions, is not the only factor involved, as the deficit also appears, though more faintly, in the pyramids obtained under assumption 1.

As the effects of the 1970-1973 drought were observed in our population pyramids, we considered the solution of a similar natural phenomenon affecting the population aged about 43. We therefore considered the years 1932 to 1938, roughly the period when this population was born. Figure 4 shows that in 1932 the annual rainfall registered at Kedougou was under 1 000 mm, a phenomenon only observed twice between 1922 and 1960 : in 1942 and in 1932. In the latter case, the severe drought — the worst ever registered in this area — was aggravated by the fact that 1931 was already a particularly dry year. Local colonial records report a terrible famine in 1933. As the critical period each year is situated between the moment when all last year's crops have been consumed and this year's crops are not yet harvested — that is, from June to September in Kedougou — this explains that the famine appeared in 1933, a year after the drought. No other famine is reported until Independence in 1960.

The deficit noted around age 43 is therefore, in all probability, related to this famine, but the dates do not quite correspond. Concerning the effects of famine on a population, we know that mortality increases, especially for young children, and fertility may be affected by an increase in the number of abortions and temporary amenorrhoea [10]. The 1973 famine should therefore affect all the generations born between 1930 and 1934.

If we accept that the deficit observed in our age-structure is related to the 1933 famine, the difference of some two to three years must be due to an average under-estimation of two to three years in the ages of those born during this period.

We have therefore increased the mean age at circumcision of men circumcised prior to 1950, as indicated in Figure 7.

C. — Our best results : assumption 3

For assumption 3, we introduced two new modifications :

- Firstly, we brought mean age at circumcision in 1980 up to 14 years, in order to increase the age of young mothers at childbirth.
- Secondly, we adopted a new model for mean age at circumcision, with more regular variations to avoid the sharp angle observed in 1950 : to smooth the curve, we started the decrease earlier and at a higher age, 18 years in 1920, 17 in 1940 and 16 in 1950.

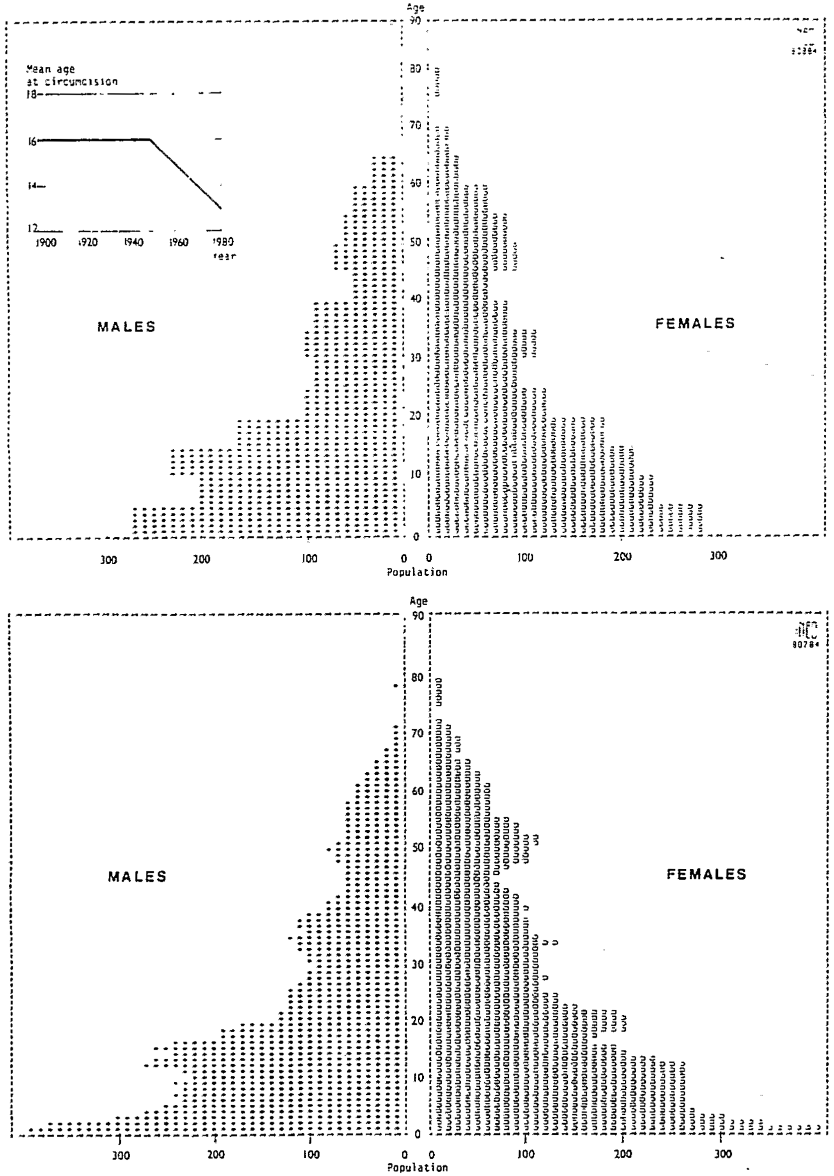

Figure 6. — Population pyramids by quinquennial age-groups and by smoothed individual years of age, March 1st 1979. Assumption 2

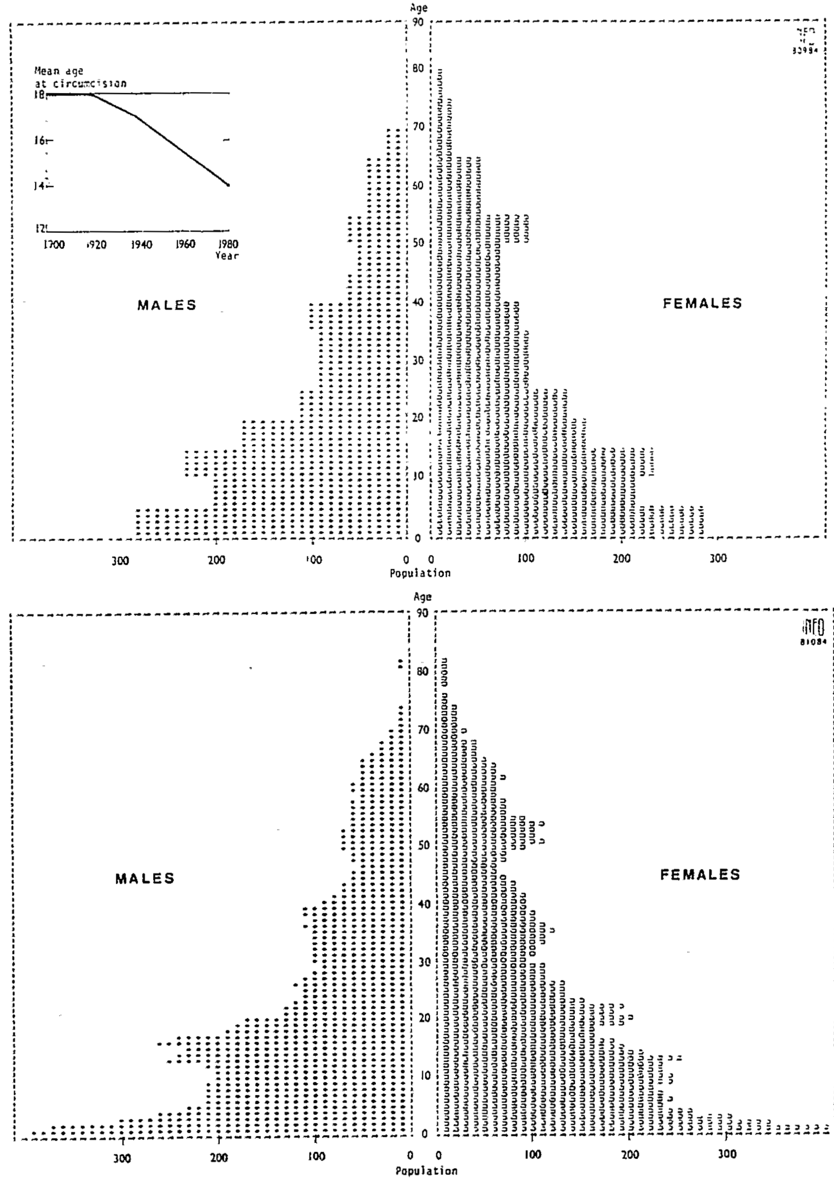

Figure 7. — Population pyramids by quinquennial age-groups and by smoothed individual years of age, March 1st 1979. Assumption 3

App. table 2 gives the detailed age-structure obtained with assumption 3. We computed two sets of results, one for individuals born in the survey area, for whom age was obtained by calculation, and the other for those born elsewhere (8 % of men and 10 % of women) for whom we used the age declared, corrected empirically for such information as the number of children for young women. This second set, of dubious quality, also includes the old women born in the zone, for whom we could only estimate a minimum age (see above).

The population pyramids obtained with assumption 3 are illustrated in Figures 7 and 8, Fig. 8 also giving the results for the non-survey population.

As expected, a strong deficit is observed at ages 5-9, and the one affecting those aged around 45 is now fairly well centred on 1933.

Another important deficit is observed at ages 20-35, especially for males. This reflects migration, many young men leaving their villages to find work in town, or enlisting in the army, and some of them, so far, coming back several years later to marry.

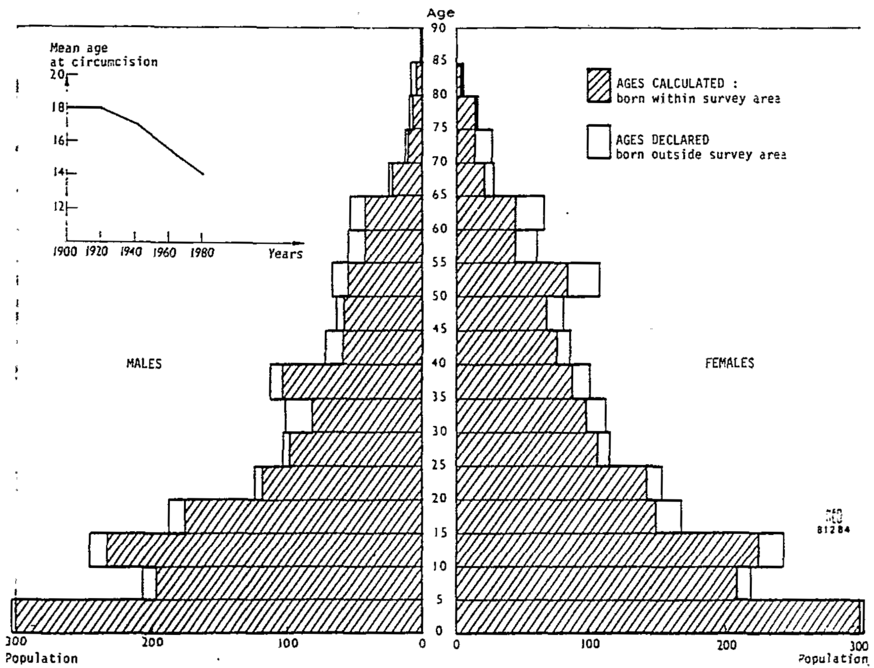

Figure 8. — Population pyramid by quinquennial age-groups, March 1st 1979. Assumption 3. (Population born within and outside survey area)

The age-structure also reveals an excess of females as of age 45, which increases at the higher ages. The phenomenon is partly masked by the very poor quality of the estimates concerning a large proportion of these women : those born outside the survey area, and those who can only be given a minimum age. In both cases, their ages are strongly underestimated as of age 50.

Three other assumptions were tested, but being very similar to assumption 3 they barely modified our last age-structure. The small size of the population observed and the method adopted limit the extent to which we can refine our estimates.

As our assumptions were tested and improved by means of the fertility calendar, we have also presented the age-specific fertility rates obtained with assumption 3, based on the 704 births registered between 1975 and 1979 (App. table 3 and Figure 9).

The 4 births observed before age 14 and those after age 50 are improbable : we may put them down to the degree of imprecision which remains and also, for the women in older age-groups, to the poor estimation affecting a large proportion of them (20 % at age 50-54).

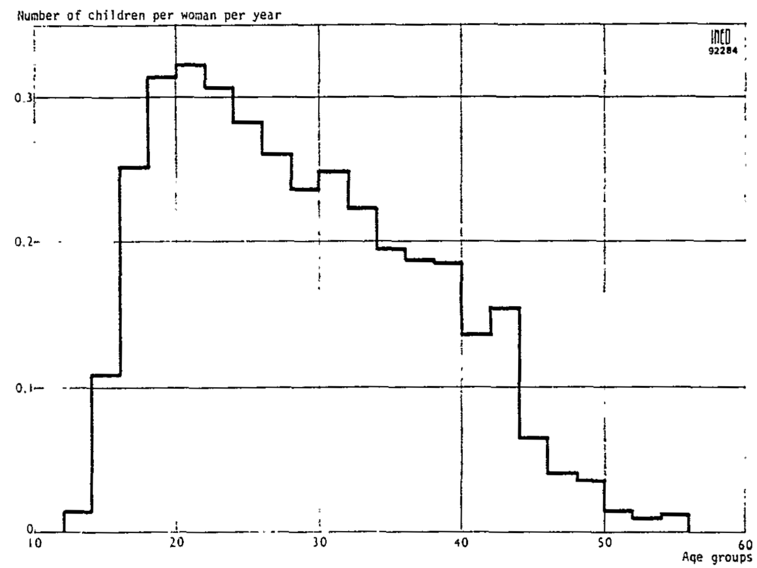

Figure 9. — Variations in the annual age-specific fertility rates observed between 1975 and 1979. Biennial age-groups. — Assumption 3

Conclusion

The ages we have estimated with assumption 3 may be said to be true to a year or two, except for the very high age-groups.

Although this degree of imprecision remains for individual ages, our estimation is an enormous improvement on the results obtained so far with traditional methods of estimating age in non-registered populations.

If we consider the age-structure, however, where ages have been estimated together instead of separately, we have obtained an exceptionally high standard of precision. This is proved by the reflection in the age-structure of a famine which occurred 50 years ago.

The method adopted is unfortunately difficult to implement, as it demands a great deal of time, especially for classification, and a good personal acquaintance of the population observed. Finally, interesting results can only be obtained when the traditional structure of society remains intact, not yet submerged by industrial civilization, as our method depends on the existence of this intricate network of social relationships without which birth classification is impossible.

For these reasons, our method is more particularly suited to monographic studies of small traditional populations.

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Translation : Linda Sergent

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Appendixed Table 1. — A DETAILED EXAMPLE OF BIRTH-RANK CLASSIFICATION. THE VILLAGE CHOSEN IS NOW SMALL — 55 INHABITANTS — BUT MUST HAVE BEEN MORE IMPORTANT IN THE PAST

Classification rank	Sex	Identification number	Name		Year of circumcision for males	Those no longer living in the village (women married outside, male emigrants)	Age computed at 1-3-1978
40	F	3 563	Fula	Kamara		+	30.80
39	F	503	Diuma	Diallo			30.24
38	M	4 424	Tongole	Ba	1964		29.69
37	M	6 587	Yura	Diallo		+	29.27
36	F	4 173	Aminata	Diallo			28.86
35	F	2 954	Malado	Kamara		+	28.44
34	M	4 189	Bokar	Diallo			28.03
33	M	7 441	Sara Boi	Diallo	1964	+	25.37
32	M	4 180	Abdullai	Diallo	1969		22.87
31	F	4 425	Adama	Diallo			22.10
30	F	4 403	Sira	Ba			21.32
29	F	3 541	Awa	Kulubali		+	20.55
28	F	3 281	Ussu	Ba		+	19.77
27	M	4 423	Tamba	Ba	1974		19.00
26	F	4 194	Diauli	Diallo			18.54
25	F	3 106	Mariama	Diallo		+	18.08
24	F	4 428	Kumba	Kulubali			17.62
23	F	4 416	Kadidia	Ba			17.15
22	M	4 408	Bedari	Diallo			16.69
21	F	4 192	Maimuna	Diallo			16.23
20	M	4 195	Bala	Diallo	1978		15.77
19	F	4 440	Binta	Ba		+	15.33
18	F	5 927	Ndiubu	Diallo		+	14.88
17	M	4 407	Talibe	Diallo	1978	+	14.44
16	M	4 433	Muktar	Kulubali	1978		13.11
15	F	4 441	Alarba	Ba			12.45
14	F	4 196	Fatumata	Diallo			11.78
13	M	4 434	Bilali	Kulubali			11.10
12	M	4 409	Sega	Diallo			10.42
11	F	4 198	Usei	Diallo			9.75
10	M	4 197	Assana	Diallo			9.07
9	F	5 925	Aissatu	Diallo			8.39
8	F	4 435	Adama	Kulubali			7.71
7	F	4 178	Aissatu	Diallo			7.03
6	M	4 199	Tierno Amadu	Diallo			6.36
5	F	4 415	Fanta	Ba			5.68
4	M	4 175	Pate	Diallo			5.00
3	F	6 431	Wuri	Kulubali			4.33
2	F	4 179	Assi	Diallo			3.67
1	F	4 426	Kamissa	Ba			3.00

Appendixed Table 1. — (Contd.)

Classification rank	Sex	Identification number	Name		Year of circumcision for males	Those no longer living in the village (women married outside, male emigrants)	Age computed at 1-3-1978
81	M	3 769	Geladio	Diallo	1915	+	81.30
80	M	4 170	Bala	Diallo	1923		72.90
79	F	7 692	Pendadio	Diallo		+	72.28
78	F	4 171	Awa	Diallo		+	71.66
77	F	4 244	Aminata	Diallo			71.04
76	F	3 770	Diue	Diallo		+	70.42
75	F	4 417	Sira	Diallo		+	69.80
74	F	4 186	Mata	Diallo		+	69.18
73	F	3 794	Mariama	Kulubali			68.56
72	F	3 237	Diba	Diallo		+	67.94
71	F	5 926	Sira	Ba		+	67.32
70	M	4 400	Wuri	Diallo	1932		66.70
69	M	3 086	Umar	Diallo	1932	+	63.70
68	F	1 329	Gulo	Diallo		+	61.12
67	M	3 100	Bubakar	Diallo	1935	+	58.55
66	F	7 695	Kamissa	Diallo		+	56.64
65	M	6 049	Pate	Diallo	1946	+	54.72
64	M	319	Yero	Diallo		+	54.41
63	F	3 573	Kumba	Kulubali		+	54.10
62	F	2 436	Binta	Diallo		+	53.79
61	M	4 430	Bala	Kulubali	1946		53.47
60	M	4 172	Usman	Diallo	1946		52.22
59	M	6 576	Mamadu Yero	Diallo	1946		50.97
58	M	5 920	Tongode	Kulubali	1946		49.72
57	M	3 682	Ali	Ka	1946		48.47
56	F	4 872	Ramata	Diallo		+	47,46
55	M	324	Dabi	Diallo	1948	+	46.45
54	M	341	Boi	Diallo	1954	+	43.47
53*	M	4 176	Amadu	Diallo	1951		40.25
51	F	4 212	Assi	Diallo			39.47
50	F	1 201	Kumba	Dium		+	38.68
49	M	3 773	Geladio	Diallo	1957	+	37.90
48	F	3 155	Gulo	Kulubali			37.27
47	M	4 410	Mussa	Diallo	1957		36.65
46	F	4 259	Kadidia	Diallo		+	35.81
45	M	346	Sadaba	Diallo		+	34.97
44	M	6 586	Addul	Diallo	1964	+	34.12
43	F	3 410	Binta	Diallo		+	33.20
42	F	3 467	Batuli	Diallo		+	32.27
41	M	329	Mamadu	Diallo	1959		31.35

* The person of rank 52 was withdrawn after classification.

APPENDIXED TABLE 2. — AGE-STRUCTURE AT MARCH 1st. 1979, ASSUMPTION 3. THE FIRST FIGURES REPRESENT THE RESIDENTS BORN WITHIN THE SURVEY AREA, THE SECOND, THE TOTAL NUMBER OF RESIDENTS

Age at last birthday	Population							
	Individual years of age				Quinquennial age-groups			
	Male		Female		Male		Female	
0	78	78	77	78				
1	73	73	67	69				
2	56	56	55	55	295	297	293	296
3	44	44	53	54				
4	44	46	41	41				
5	43	44	36	39				
6	40	44	43	45				
7	34	35	60	62	201	211	215	225
8	37	39	46	47				
9	47	49	30	32				
10	41	43	47	50				
11	37	40	43	46				
12	32	33	50	55	232	246	225	244
13	45	48	43	47				
14	77	82	42	46				
15	33	37	18	18				
16	30	33	23	27				
17	49	53	35	41	173	185	148	166
18	32	32	29	31				
19	29	30	43	49				
20	34	35	36	37				
21	20	22	36	40				
22	17	18	27	27	120	125	142	153
23	24	24	28	32				
24	25	26	15	17				
25	23	24	16	16				
26	22	24	36	38				
27	19	20	21	23	97	102	105	114
28	17	18	17	19				
29	16	16	15	18				
30	12	15	14	15				
31	24	37	19	23				
32	18	18	26	32	80	99	96	111
33	15	18	18	19				
34	11	11	19	22				
35	20	22	15	17				
36	27	30	20	28				
37	26	27	20	22	104	114	86	99
38	15	16	17	18				
39	16	19	14	14				
40	13	16	15	15				
41	15	20	19	24				
42	10	13	18	21	59	71	75	84
43	11	11	14	14				
44	10	11	9	10				
45	6	7	10	10				
46	16	18	10	15				

APPENDIXED TABLE 2. — (Contd.)

Age at last birthday	Population							
	Individual years of age				Quinquennial age-groups			
	Male		Female		Male		Female	
47	7	8	14	20	57	63	67	79
48	13	14	19	20				
49	15	16	14	14				
50	11	16	22	27				
51	14	18	14	28				
52	11	13	10	11	56	67	82	108
53	11	11	17	20				
54	9	9	19	22				
55	7	11	12	13				
56	12	14	8	11				
57	11	13	7	8	43	55	44	59
58	9	13	9	18				
59	4	4	8	9				
60	12	14	15	19				
61	11	14	9	15				
62	8	9	7	10	44	54	43	64
63	6	8	2	6				
64	7	9	10	14				
65	7	8	6	9				
66	3	5	5	8				
67	6	6	3	3	22	25	22	28
68	2	2	5	5				
69	4	4	3	3				
70	3	4	2	12				
71	3	3	4	5				
72	0	0	2	3	11	12	14	26
73	2	2	3	3				
74	3	3	3	3				
75	1	1	3	3				
76	2	3	1	1				
77	2	2	1	1	7	10	13	15
78	1	1	3	4				
79	1	3	5	6				
80	2	2	2	3				
81	1	4	1	1				
82	1	2	0	1	4	8	3	5
83	0	0	0	0				
84	0	0	0	0				
85	1	1	0	0				
86	1	1	0	1				
87	0	0	0	0	2	2	0	1
88	0	0	0	0				
89	0	0	0	0				

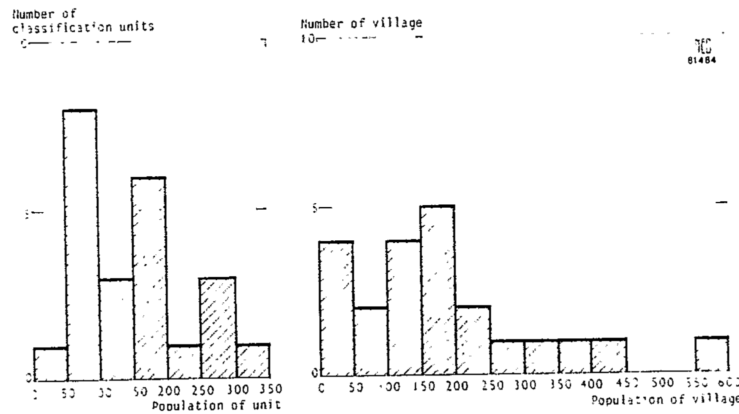
Total	Male		Female		Total	
	1 607	1 746	1 673	1 877	3 280	3 623

APPENDIXED TABLE 3. — AGE-SPECIFIC ANNUAL FERTILITY RATES (BIENNIAL AGE-GROUPS) BETWEEN 1975 AND 1979. ASSUMPTION 3

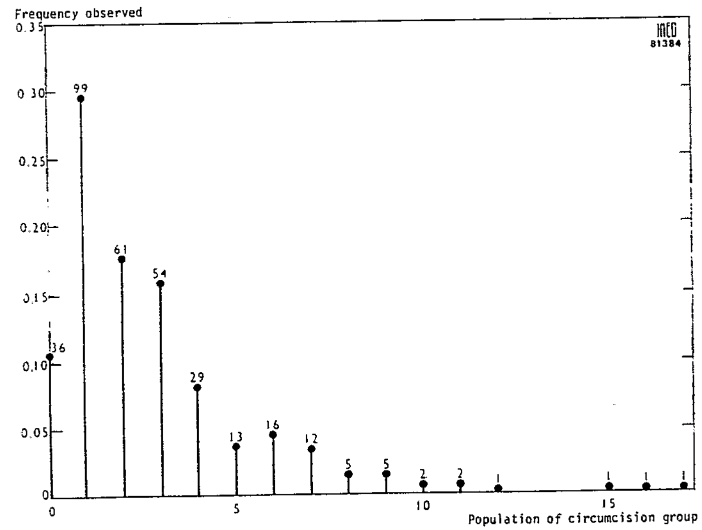
Age-groups	Number of births	Mean number of women (*)	Annual fertility rates
12-13	4	71,75	0,013
14-15	28	64,25	0,108
16-17	78	77,50	0,251
18-19	94	74,75	0,313
20-21	74	57,50	0,321
22-23	60	49,00	0,306
24-25	54	48,00	0,281
26-27	42	40,25	0,260
28-29	40	42,50	0,235
30-31	46	46,25	0,248
32-33	39	43,75	0,222
34-35	33	42,50	0,193
36-37	27	36,25	0,185
38-39	27	36,50	0,184
40-41	18	33,25	0,134
42-43	16	26,00	0,153
44-45	8	31,75	0,063
46-47	6	40,00	0,037
48-49	6	41,75	0,035
50-51	2	39,25	0,012
52-53	1	31,50	0,007
54-55	1	25,00	0,010

(*) Computation of the mean number of women by age-group for the period 1975-79 was based on the age-structure at 1.3.1979, ignoring mortality. For the age-group n, $n + 1$, the number of women was obtained by adding :

$$\frac{1}{8} E_n + \frac{3}{8} E_{n+1} + \frac{1}{2} E_{n+2} + \frac{1}{2} n{+}3 + \frac{3}{8} E_{n+4} + \frac{1}{8} E_{n+5}$$



Appendixed figure 1. — Distribution of villages and classification units according to population size. [21 villages and 23 classification units in all]



Appendixed figure 2. — Frequency of circumcision groups in terms of number of living members (with indication of absolute number of circumcision groups). [388 circumcision groups in all]

PISON Gilles. — **Calculating Age without Asking for it. Method of Estimating the Age and Age-Structure of the Peul Bandé (Eastern Senegal).**

In studies of populations in which there is no civil registration, the problem of mis-statement of age is important. A method for determining age, which is wholly independent of stated age, is proposed in this paper. The principles of the method are set out in the first part and, in the second part, the method is applied to a rural population of Eastern Senegal, the Peul Bandé.

The method inspired by geology is based on the construction of chronologies for two different classes: one in which individuals are ordered by birth-rank in each village and another of the years when circumcision was performed for all the villages.

By constructing an absolute chronology of circumcision festivals and making assumptions about the mean age at circumcision, the age of every individual can be calculated. The sensitivity of the results to variations in the assumptions and the method of calculation are discussed in connection with the Peul Bandé, and an attempt is made to estimate the accuracy of the ages calculated.

PISON Gilles. — **Calcular la edad sin hacer una pregunta al respecto. Método de estimación de la edad y de la estructura por edades de los Peul Bandé (Sénégal Oriental).**

Los estudios de poblaciones carentes del registro civil, tienen el inconveniente de los errores de las edades declaradas. Se propone un método de estimación de la edad, totalmente independiente de las declaraciones de la edad. En la primera parte se exponen los principios del método y en la segunda se presentan los resultados de una aplicación de este método a una población rural del Sénégal Oriental, los Peuls Bandé.

El método se inspira la Geología, y se basa en la reconstitución de cronologías relativas mediante la clasificación en estratos. En el caso de las poblaciones se efectúan dos clasificaciones: una ordenación de los individuos por orden de nacimiento en cada aldea y una ordenación por clases de las promociones de circuncisos para el conjunto de las aldeas.

Se efectúa una cronología absoluta de las fiestas de circuncisión y se formula una hipótesis acerca de la edad media en el momento de la circuncisión, lo que permite una en el momento de la circuncisión, lo que permite una estimación de la edad de todos los individuos de la población.

Sobre la base del ejemplo de los Peuls Bandé, se discute la influencia de las hipótesis y del modo de cálculo sobre los resultados y la precisión de las edades así calculadas.

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