

## THE DIFFERENT PACES OF DEVELOPMENT OF SCIENCE AND CULTURE: THE CONSIDERATIONS OF A DEMOGRAPHER

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1. I am sorry, I am not familiar with cultural anthropology and I am afraid that something in my speech will sound amateurish. May I hope that, at least, my mistakes will not be too bad. As a way out, I will try to consider culture in the largest sense: including knowledge, customs and beliefs, ways of living, of expression and communication, going from legislation to stories and art, from books to databases and tools, and so on. In my opinion, in shaping a culture the level and content of knowledge comes first. But immediately, connected with it, and through evaluation of it, come decisions and behaviour. Behaviour means choices, and these imply free will and a certain amount of freedom. And it is linked to a strain towards targets.

This is obtained at the level of each individual person, with ensuing heterogeneity of subjects. Within a population, culture may be differently characterized by groups of people in some way connected and providing evidence of homogeneity under some aspects. By families, first of all. I think it has happened to each one of us to be uncertain on the phone whether we were speaking with the mother or the daughter, so indistinguishable was the tone of the answer and of the voice. And we have evidence of a sort of family lexicon. To be crude, blasphemy seems to belong to a family lexicon, transmitted through the male line. The relation between the level of education of the mother and the success of children at school has been repeatedly emphasized. And so on.

More usual is to associate the idea of a culture with that of a population by and large sharing it. But culture has many facets, and subgroups in a society are identified by particular features characterizing them. Divisions by town and country, level of education, employment status,

etc., within a society are usual covariates considered in studies of differential demography. Certain characteristics qualify both subgroups within a country and populations across countries: language, race, religion are among them. They are factors of distinction as well as cohesion. I remember well what I heard in 1994, at the UN Conference on Population and Development in Cairo. A Muslim delegate of an intergovernmental organization was on stage at a plenary session, and I heard him proudly declare: 'We are a billion and a half; in ten years we will be two billion'. A distinction in one of these characteristics is generally associated with divergences along other lines: from a demographic point of view, in behaviour in front of events and decisions concerning human life. But not necessarily everywhere in the same manner.

Characterizing elements like those just mentioned are enduring factors shaping a cultural trait. An Italian colleague had made an in-depth study of the history of fertility in Spain. He happened to show the results to a Spanish colleague. This colleague, expert in the history of the country, was astonished and explained that the obtained map of fertility levels by regions reproduced political divisions dating back to past centuries. May I mention a similar coincidence observed in another demographic field. I knew that Cameroon was, in Africa and in the world, the country with the highest rate of sterility. I happened to find a study mapping finely determined African regions with high sterility levels, with particular attention to Cameroon. This map allowed the identification of the trails followed by raids into the various zones. Not only did the slavers spoil indigenous populations of human capital, they also left behind as an added offence a diffusion of sexually transmitted diseases.

2. The influence of cultural traits on behaviour modelling demographic phenomena can be traced back to well before the heavy impact of modern science and technology. May I mention three examples.

In Europe, where the relevant documentation exists and can be exploited, seasonal trends of births have been ascertained. For a long time in the past, higher rates appeared to be reached in late winter and early spring, lower in autumn and early winter. The reverse was documented for some regions of the Southern hemisphere. This phenomenon was seen at every latitude. At the same latitude, instead, birth seasonality differed, at least somewhere, between town and country. Such observations led someone to hypothesize a behaviour, in the countryside, consistent with the intent of having available all human resources just in time for when work in agriculture most needed them.

On the other hand, man had proved unable to manage adequately the struggle against sickness in the case of large epidemics. Empirical observations during plague episodes had consistently taught the lesson of the risk of contagion. Therefore, when a notice came of an instance of infection in some place, the borders of a town were rapidly sealed, and the entrance of persons or products was admitted only under strict conditions. This terribly damaged the local economy, but was felt necessary. Moreover, diseased persons were isolated in *ad hoc* institutions, and their homes were closed and disinfected. Those populations did not know what science later found about invisible beings and rats and fleas carrying them around. These defeated guards at the entrances and interventions on isolated buildings.

Finally, following John Hajnal, imagine on a map a line going from St. Petersburg to Trieste dividing Europe into two parts. In the Western part, the age at marriage for both sexes and the percentage of population that never married at all had been for centuries, since the end of the Middle Ages up to that of the *ancien régime*, much higher than in the Eastern one. In a prevaillingly rural economy, availability of exploitable land and laws of inheritance are supposed to have been major factors in shaping behaviour. This – by the way – allowed to rely on the valve of flexible nuptiality habits to repair the ravages of plague crises.

3. In any field a time lag appears between a new scientific or technological finding and the taking advantage of it by interested people for their specific purposes.

First of all, in scientific work itself. In my field, for instance, it was noticed that a leading journal of biostatistics hosted a paper making reference to Mendel's theory only in the late 20s. Locally, the attention to heredity centred around different aspects and approaches. Biases of schools were at work. In 1954, at the UN World Population Conference in Rome, a participant coming from Eastern Europe presented a paper about changes in population characteristics due to marriages and migratory movements. He stated that these changes were due to economic, social and political factors, not to genes: 'Simply because genes do not exist. They are a myth'.

Coming to an area in which I am personally involved, I mention the new horizons opened by the computer.

I was born too soon. I am not referring to my age, but to the circumstance that my classical preparation in statistics was done before the birth of the personal computer. The PC allowed new chapters in statistical methodology and in computational statistics to be opened. May I mention an exercise performed by a colleague with the students attending his lec-

tures in statistics. A double set of issues of leading journals, one some thirty years old and one of the most recent years, was scanned. It was found that in statistical applications in the oldest journals about 10% of the papers appeared to use a Bayesian approach. At that time there was a great controversy between those accustomed to classical approaches and those relying on Bayesian procedures. In recent years said rate increased to 50%. Personally – owing to heavy engagements in activities outside research and teaching – I did not find time to catch up with developments in the two fields. My efforts proved sufficient to understand the substance and the limits of these developments. But I realize that, when I want to follow new lines of research opened by continuously updated techniques, I need collaboration.

Computers have shown possibilities and created problems also in other areas. I am referring to the so-called data mining. It consists in techniques of analyzing data when they come in enormous amounts: contacts through cellphones, visits to websites, databases of administrative acts, etc. In a recent meeting I heard a speaker raising questions about the philosophy of the approach to an analysis of data. He praised, through those methods, the greater respect of real facts. The classical approach through models was thought to impose an unwarranted theoretical pattern to an unknown matter.

Considering again computers, they provide an example of advancement of science and technology in one area, computing, that generates questions to be solved in a quite different one. The software that makes the computer work is a typical example of an intangible good. How can it be evaluated and treated in national accounting and matrices? At the level of the cost of licences? But the same good can generate quite different values of outcomes with a change in applications. And what about when it arrives free of charge, as it happens with Linux or the functions and scripts of the R project? Great attention has started to be given in economic accounts to this kind of goods: like tourism, terribly damaged by a horrible event.

4. The last example shows how an innovation in one field might induce unintended consequences in another one. This reminds me of a debate made in this room less than four years ago. Some participants raised objections against the spread of genetically modified products in agriculture fearing that this could mean favouring a dominant corporate food system based on large farms and monocultures. To that were opposed the merits of a system of small farms, more productive on the whole, and 'multi-functional', acting also as a basis of a diffused culture and of political equilibri-

um. I certainly do not want to enter into this discussion, but I wish to underline one aspect of this 'multi-function' of an agricultural enterprise. I recall a statement made about half a century ago by Prasanta Chandra Mahalanobis, a top Indian statistician: 'If you want to lower the birth rate in India – he said – you have to foster improvements in agricultural activities'. The idea was, I think, that rationalization in one important aspect of human life such as labour could favour rationalization in another important one such as reproductive behaviour.

This leads me to underline the links existing also between different components of demographic developments. They are strong, lasting and pervasive, so that a disturbance in one of them entails consequences in others. May I illustrate this point through an example.

Fig. 1 shows the relation, over an interval of about 40 years, between the sex ratio (surviving males over females) and age in 1970 in the populations of three countries: the United States, the German Federal Republic, the German Democratic Republic. In the population of the United States one notices the usual descending trend of the ratio with increasing age due to the higher mortality of males. In both German Republics in two distinct intervals a roughly constant level with advancing age is put in evidence. The second one, at the oldest ages, depends on outcomes of the First World War. The previous one, of the Second. In this last, the difference in the level of the ratio in the two German populations is due to selective migration from East to West in the postwar period before the building of the wall. These persisting imbalances in populations which at the end of the war were between, say, 20 and 40 years of age must have created constraints to nuptiality, thus lowering the birthrate. With it will change the rate of population increase, the age structure, the death rate. What I want to underline is that demographic developments may be characterized by a slow pace, but they are relentless. And I do not mention, now, the interaction with induced social and cultural changes and their feedback on the causing factors.

5. But let us now concentrate on the extraordinary social phenomenon named demographic transition by Frank Notestein and *révolution démographique* by Adolphe Landry. That is, the passage from a practically stationary population characterized by high birth and death rates to a similar situation in which both rates are low. This change was completed in the Western world in roughly one century and a half. Due to the more rapid decline in fertility, the size of the population in the countries of the region increased very much. I will avoid the boredom of figures and will not enter

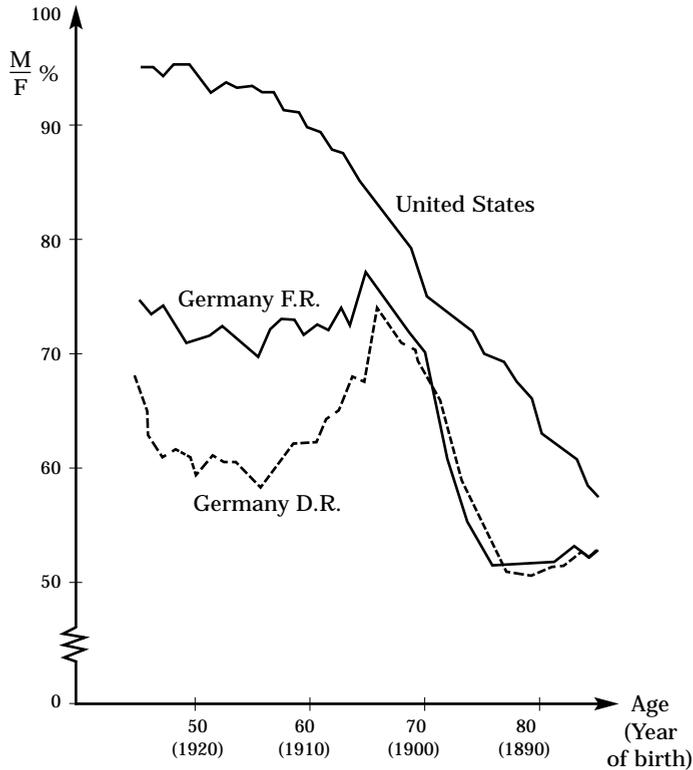


Fig. 1. Sex ratio by age, 1970.

into the debate on factors responsible for the decline of mortality. I will only mention a few of the several explanations advanced about the descending trend of fertility. Besides decreasing mortality, industrialization, education, urbanization, secularization, and so on have been underlined. But no generalization can be done. For each supposed causal factor, marked exceptions exist. Industrialization started first in England, well in advance of any important fertility decline. Compulsory schooling was adopted in Germany much before any perceptible shrinking of the birthrate. According to Ronald Freedman, the postwar baby boom disproved for the States the hypothesis on secularization.

Before the beginning of the change a limitation of births existed already in restricted circles: among members of the nobility and, in Italy, in some Jewish communities. The spreading of this behaviour within the general population definitely preceded any important contraction in mortality. It happened in the countryside, northwest of Paris, in France, decades before the revolution.

It has been suggested that this local behaviour may have been responsive to the supply of land. But it can be observed that France did not feel the need to take advantage of migration to the open territories of the New World. A French Canadian historical demography expert complained that in actual fact there had been a minimal flow of migrants from France to North America over a century and a half. French people, who were the first to settle on the St. Lawrence bay and the Mississippi delta, missed the opportunity to link the two original communities through facilities of rivers and lakes, giving by that another turn to historical developments. Throughout the nineteenth century fertility continued to decline in France more than anywhere else in Europe. Bertillon in 1895, seeing that the births in his country were half of the German ones, was frightened. He stated that he expected the outbreak of a war twenty years later.

I have mentioned these opinions in order to stress the importance of possible outcomes of demographic behaviour. But I immediately want to call attention to two basic points. In France, and anywhere else in Western Europe, the transition was not the consequence of any direct intervention of public authorities. It depended on decisions taken at the level of individual families. And this transition came to an end well before the discovery of the pill or of any other medical contraceptive. At the time of the world crisis of 1929-31, fertility in some countries had fallen down to about replacement level. The old valve of nuptiality was already exhausted. The change was due to traditional methods, coitus interruptus, abstinence, some rough condoms, and the like. And to induced abortion, presumably. I have never met reliable evaluations about its impact in past times. Folk methods may have been used, but I think that it is fair to suppose that it was a risky enterprise, apart from legal sanctions.

Given these facts, one might rightly ask which is the role played by advances in science. Before trying to give an answer to this question, let us glance briefly at what has been happening since the last war in developing countries.

6. From Jenner, to Koch and Pasteur, and to Fleming, to mention only some symbolic names, the art of medicine in a century and a half has

made extraordinary progress in every field, in prevention, diagnosis and therapy. Its great results were supported by improvements in living standards and in the organization of the public health system. All that scientific and technical knowledge was potentially available to any country at the end of the last world war. The enlarged possibilities of contacts with the developed world made possible in underprivileged regions the acquisition and spreading of knowledge, practices and products which had taken a long time to accumulate. But their application met with formidable obstacles. I do remember that I noticed, in a statistic of the WHO, that in a country there was a physician for every sixty thousand people. And I do not mention conditions of hygiene and undernutrition.

In spite of such severe limitations, the decline of mortality in the developing world has gone on much more rapidly than in the past in the more advanced regions. Certainly, a good deal more is needed to reach the levels obtained elsewhere, but the road is open, though with added hindrances. For instance, in sub-Saharan Africa, AIDS epidemics have caused the waste of much of the gains. But improved economic conditions, advances in educational resources and rearrangements in social organization will presumably allow the levels of control now prevailing in more affluent regions to be reached.

The better control of sickness and the lowering mortality meant enormous savings and advantages. For instance, it reduced the wastage of economic resources spent on bringing up babies who did not reach maturity. This fact increased human resources available in better health in productive lifetime. At the same time, it created conditions favourable to an increase in the already high fertility. More people survived to reproductive age, and were kept in good health through it. People then realized that it was no longer necessary to procreate many children to have a reasonable number of surviving ones at older ages. The contraction of the birth rate was the appropriate response to the new conditions.

At first, natality remained high, so that the rate of growth of the population steadily increased up to a level never reached in the past by any population. Later on, the fall in mortality was followed by a similar drastic drop in the birthrate. The main instruments used in this decline were no longer the traditional ones. New tools came to the forefront, all depending on new knowledge, products and abilities: pills, IUD, injectables, sterilization, in some cases induced abortion. Pressure from governments, in a variety of forms – even compulsory in some places – coupled with international urging have been moving rapidly in that direction. These external actions met

with developments on the demand side of families facing new situations. But one point must be underlined. The fight against diseases and for survival is one-sided, and this simplifies choices and behaviour and makes it easier to foresee future developments. Procreation is a much more problematic area. Competing values and interests, at the level of involved couples, changing in time and meeting variable conditioning factors, led to heterogeneous behaviours, whose outcomes cannot be easily forecasted.

7. The last observation concerning uncertainties in evaluating facts and their developments in the demographic field has to be kept in mind when coming to an in-depth consideration about the timing of the adjustment of a cultural background. To this can be added that some events and realities are still puzzling and escape explanations. Take the sex ratio at birth – this pivot of our biological and social life – and its systematic variations between selected groups of newborns. After hundreds of proposed hypotheses, we might use an expression of Francis Bacon: ‘What was a question once is a question still’. To take another example, it is hard to find the factors which determined the rise of the birthrate during the last war through 1945. From the States to Australia and New Zealand, through France and England and Wales, this happened in countries involved in the conflict and also in some – like Sweden and Switzerland – who were neutral but near the area of operations. And no demographer foresaw the baby boom up to the peak of 1960 in the States and of 1964 in Western Europe.

Dissection of a social phenomenon in an effort to identify clearly responsible factors is a difficult exercise, always in danger of falling in the fallacy of spurious correlations or of *post hoc ergo propter hoc* sequences.

We have seen that success in controlling mortality imposed as an unintended consequence a parallel containment of births. This happened, at different paces, in developed and developing regions. On the whole, as I have already had the opportunity to underline, mankind is now compelled to give up much of its potential fertility. The decline in mortality is in the forefront everywhere. Products, gadgets and techniques for checking fecundability play in general a minor role, simply more or less facilitating the itinerary towards a needed target. The variety of choices among societies and individuals reflect both cultural heterogeneity and consequences of external pressures on the supply side. Both take time in the expression of their weight.

8. In order to better clarify this question of timing in social adjustments, I choose a case study. For several years Italian fertility has been well below

replacement level. With 1.2 children per woman it is now at the lowest level in the world. It is well below replacement level. It is only about two thirds of that prevailing in France. What can be an explanation of such a difference?

In French society, the negative experiences of the past may have caused a sort of *revirement* in the general attitude. A new mood that, after the First World War and the great economic crisis, led to the approval in 1939 of the *Code de la famille* of the *Front Populaire*. This code included much more weighty measures in favour of families than those provided at about the same time in Italy. The demographic policy of the Fascist regime was very vociferous but substantially weak. I leave apart, naturally, the insults of antisemitism and the arrogant inconsistency of wanting at the same time more people and more space to lodge them. In recent decades in my country the baby boom has left space for a downward trend, in marriages first, and then in marital and general fertility. With the said 1.2 children per woman, we are far from the two children considered to be ideal for a family in answers given in several representative sample surveys. In my opinion this is a signal of social illness.

Some twenty years ago I had the opportunity to ascertain that, in France, public finance spent fifteen times more on family allowances than Italy. At that time, a French colleague found it strange that what in his country was considered social policy, in mine had the smell of fascist policy. Italian politicians were on the same line and did not care much about what was happening.

And what was happening – and still continues to prevail – was of the utmost importance for the life of the Italian population. Such a containment of births has had a strong impact on its age structure. The shrinking of the basis of the age pyramid will entail heavy population ageing. Italy, with Japan, already now, shows the fastest rate of ageing of the world.

This situation has consequences in many fields. In economic life, first. There is an increasing shortage of young adults in the labour force, that is of the more flexible and creative workers. In numbers, it is estimated that, to keep stable the proportion of the population in productive ages, hundreds of thousands of immigrants are needed every year. Sadly, while in the more industrialized regions of the North managers long for availability of labour force, in the South there continues to be severe unemployment, especially among young people. Persisting cultural resistances create obstacles to a better internal balance.

Provisions in the field of welfare also require a drastic rearrangement of activities and expenses. Some waste of resources is expected. Empty

school buildings can be restructured for other services, but past spending to prepare teachers who are now out of work are lost. And it is probably not simple to convert a paediatrician into an expert of geriatrics. Certainly those who survive, say, at 65 years of age are nowadays on the average in better health than ever in the past. This makes it reasonable to postpone the age of retirement. However this solution plays against the prospects for the career of young people. There arises an intergenerational conflict of interests for which there are no easy solutions.

The most rapidly expanding segment of the population is that of the oldest old, say of people beyond 80. Among them, there is the highest proportion of persons who are not autonomous and self-sufficient: a proportion which is definitely higher, furthermore, among the poorest social classes. Most of the ensuing problems of help and assistance are now left in the hands and on the shoulders of families. This imposed onus is at the origin of much suffering especially for underprivileged units. This is a specific aspect of a more general problem. In fact, besides biological ageing, there is a social ageing ending in isolation and exclusion. Old people have lost much of their value as depositories of experiences and transmitters of knowledge. Their worst expectation is to live in solitude.

In Italy, the fraction of aged persons cared for in institutions is lower than in other similar societies. One may impute this deficiency to a lack of wisdom of politicians who failed to understand what was going on and came slowly and late to proper action. It is normal for politicians to look for immediately visible results of their intervention on today's problems. But a sense of solitude may be felt also in institutions. And most of the problems arising from isolation in a society are in the hands and under the responsibility of the behaviour of the people themselves. The contraction in the number of births impoverishes vertical family links – between children and parents and grandparents – which could provide better company and help for the aged. At the same time it offers less opportunity to enjoy horizontal ones through relatives, who are few in numbers, and live in similar conditions.

Other solutions have to be looked for to support and enrich the extended period of life, but the cultural accommodation of the society to the new conditions created by science and technology is going on only at a very slow pace. The inertia inherent in demographic movements facilitates forecasting future developments which society has to be prepared to meet. An urgent task, in my country, stimulating much attention and research.

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9. In recent times, in several developing countries there has been both a decline in mortality and a drastic substantial drop in the birth rate. The considerations suggested by our case study might guide someone in imagining scenarios that could be happening in any of them. The experience in one instance certainly cannot simply be transferred, as it was realized, to another one. But the exercise could prove useful in illuminating the road of governance and of people. Failures might be unforgiving.

## DISCUSSION ON THE PAPER BY COLOMBO

PAVAN: I would like you to tell us what you expect to have with the demographic stabilisation that will come in no more than fifty years, and how the thing will be solved, all these problems you are putting together now. And I would say that when you talk to young people and use a phrase of Dr. de Duve, 'your future is in your hands', I would say to young people, our future is in your hands. I would like to know what you think about this, what will happen with demografic stabilisation.

COLOMBO: I think that I underlined a disequilibrium. In demographic stabilisation there is a sort of equilibrium, and this will not be true in fifty years: in ten years or so there will be an almost stabilised situation. Certainly we wrongly mix the case of China, with its compulsory one-child family, with the cases of other countries which still have a high rate of increase. But I think the situation in Italy has not yet stabilised. In the future the population will stabilise.

PAVAN: Yes: but do you think that the problem will be solved by education of people or by medicine or other factors?

COLOMBO: I certainly think it is a problem of education, of personal education, of how to deal with their own problems.

PAVAN: Then we have to do a lot to achieve that.

COLOMBO: I think so.

RAO: I am glad that you ended up with education. I just want to bring some balance to this by referring to what is happening in most of the developing countries. In most developing countries, including India, the population is increasing among the very poor people. In fact, the poorest

of the poor have very large families – they cannot afford that. Most of the children have to work to maintain the family. It is the rich, the educated, who have family planning, who have one or two children. So thus begins another imbalance, economic and otherwise. There are countries that find it difficult to maintain and support such people. At the same time, education is very important for the disadvantaged. It is a very serious problem in developing countries.

COLOMBO: May I give an answer? I quote what Professor Mahalanobis said, he was a top statistician, an Indian. He said: 'If you want to lower fertility in India you have to foster improvements in agriculture', probably because he thought that rationalisation in one important aspect of life, labour, could be transferred to rationalisation in another important aspect, procreation. It is a problem of education.

IACCARINO: Yes, only a question of terminology. You used the term 'fertility', whereas in other circles, such as UN circles, they use the term 'birth-rate'. Did you use the term 'fertility' intentionally? Is it common among demographers?

COLOMBO: The word 'fecundity' is common among Italian demographers. It is translated from the French, not fertility. I changed the word to avoid boredom, but it is the same thing.