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Position of Demography Among Other Disciplines

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EDITOR'S FOREWORD

It is commonly accepted that demography originated in the middle of 17th century and John Graunt was its real founder. According to a well known late Russian demographer Boris Tzezarovich Urlanis, demography is the only scientific discipline which has an exact date of birth – when Graunt's *Observations* were published in February 1662. There were population censuses well before this date and even some information about numbers of deaths and births but the first look at these numbers as mass phenomena and the discovery of statistical regularities we owe to John Graunt. It was just 337 years ago in February 1999 and yet only a few demographers would agree as to what is demography, which problems are really demographic, what is the place of demography among other disciplines, etc.

Demography has a long history at Charles University; it was in 1899 when the first course of demography was introduced at the Faculty of Philosophy, i.e. precisely 100 years ago. It seemed opportune to convoke selected specialists from demography and neighbouring disciplines to discuss these problems without aiming to achieve any final solution. The idea was accepted and the Round Table on *the Position of demography among other disciplines* was held on the premises of Charles University in Prague on 25–26 August 1999. This volume contents revised contributions presented at the Round Table.

The first six presentations deal mainly with demography itself, how it can be conceived from different aspects. Various understanding do not deny its usefulness although the answer to whether demography is the science *is rather partial and uncertain* (David Coleman). The importance of demography's connections to other disciplines was stressed in the explanation of demographic processes (Hans-Peter Kohler and James W. Vaupel) and also integration and synthesis in demography and with other social disciplines was called for (Dirk J. van de Kaa). Demographic findings were always for the conception of social policy, which cannot be based only on our knowledge, but it has also its philosophical dimension (Guillaume Wunsch). It seems to me that further discussion should pay more attention to those topics of demography which are common with other disciplines (man, people, population) and to that subject matter which is specific to demography itself. The main focus on *formal demography* cannot help to in determining its place among other disciplines. Methods are universal according to their substance and so they do not help to distinguish the subject matter of any discipline. Every discipline has its own history and so the history of demography completes the introductory picture of the first four presentations (Eric Vilquin).

The following nine contributions deal with the of demography's connections with other disciplines, which are crucial for its own development. The significant position of methods in demography justifies the use of statistics which shares its origins with demography (Andrei Volkov) and the use of mathematics (Dimiter Philipov). The fruitful cooperation of demography with sociology has been proved in many studies and it will surely continue in the future even if *both demography and sociology maintain the specific and unique characteristics of their own disciplines* (Jenny de Jong Gierveld), because they *are commuting members of one family* (Hans-Joachim

Hoffmann-Nowotny). Demographic behaviour is a common topic of demography and social psychology (Dagmar Kutsar). Demography originated in the Czech Republic together with anthropology, although their relation has since been neglected. However, their connections are close and could be fruitful in the further development of knowledge (Robert Cliquet). Demography is also a historical discipline (Jacqueline Hecht), many demographic changes can be explained with economic factors (Janez Malacic) and geography was always very close to demography (Leszek A. Kosinski).

The contributions presented here give a concise overview of the present stage of demographic thinking and they pose more questions than provide answers. The purpose of the Round Table was not to achieve new knowledge but to pause for a while in the process of demographic cognition and to reflect what demography is and what its further development can be, as an independent discipline and/or in connection with other disciplines. Such a reflection is always fruitful because it open new horizons and gives new ideas. In all modesty I would like to express my opinion that the Round Table fulfilled this purpose.

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Prague, 18 September 2000 Zdeněk Pavlík

CONTENTS

100 YEARS OF TEACHING DEMOGRAPHY AT THE CHARLES UNIVERSITY

A Section or *Cabinet* of Anthropology and Demography was created within the Institute of Zoology at the Faculty of Philosophy at Charles University by a very well known Czech physician and anthropologist, Jindřich Matiegka, in 1897. Professor Matiegka (1862–1943) later became Rector of Charles University and the former Section developed into the Institute of Anthropology and Demography in 1911. The 1899/1900 academic year, i.e. just 100 years ago, has a special significance for the history of demography at Charles University as it was in that year that Matiegka started his lectures, entitled *Principles of Demography*. He continued lecturing in demography up to 1920, besides his lectures in anthropology (Human Races) and ethnology. His principal book, *Somato-anthropological philosophy* (1935), has kept its value for students of demography up to the present.

The Faculty of Science at the Charles University was created in 1920 and the Institute of Anthropology and Demography became part of it. Demography continued to be taught at the new faculty by František Jaroslav Netušil (1890–1927) from 1923. He was a student of Raymond Pearl and he named his semestral lectures differently every year, among them *Theory of Demography* (1923), *Demography of the Czech Lands* (1926) and *Demographic Methods* (1927). After his premature death, demography started to be taught by the actual founder of contemporary demography, Antonín Boháč(1882–1950) from 1929. His annual lectures for students from Faculties of Science and of Philosophy included *Principles of Population Science* (1929), *The System of Population Science* (1930–1932), *Results of Population Census* (1933), *Population Problems of France* (1934), *Dangerous Places in the World Population* (1935), *Population Problems* (1945), and *Nature, Population and Society* (1949).

Boháč's successor, Jaromír Korčák (1895–1989), qualified as a university lecturer in demography at Matiegka's Institute in 1947. As a geographer and demographer he became head of the Department of Economic Geography in 1950 and he continued teaching two-semester courses in demography up to 1963 (with the exception of the 1953/54 academic year), mainly for students of geography. From 1964 demography was taught by Zdeněk Pavlík (1931), who qualified as Associate Professor in 1968.

The Department of Demography and Geodemography was created in 1990. Various special courses in demography have been introduced and students can receive a degree in demography at bachelor, master's and doctoral levels. As of today, about 130 students are enrolled in demography study programmes at Charles University and courses in demography are also taught by members of the Department in the Faculties of Philosophy and Social Sciences of Charles University. The Department of Demography and Geodemography has now ten pedagogues/researchers and has been headed by Associate Professor Jitka Rychtaříková since 1999; other members are Professor Zdeněk Pavlík, and the following lecturers: Boris Burcin, Dagmar Bartoňová, Ludmila Fialová, Květa Kalibová, Jiřina Kocourková, Milan Kučera, Tomáš Kučera and Libor Stloukal.

WHAT IS DEMOGRAPHY?

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Roots of demographic knowledge

Demographic phenomena and demographic processes have been of special interest to all men and rulers since the beginning of mankind. Such events as births and deaths are crucial for the existence and development of any population and society. Man was a close observer of himself and of the nature around him. Prehistoric knowledge was limited, partial and deformed, which is not different from the present situation, in spite of the modern scientific revolution; the acquaintance with facts was, however, understandably much smaller than it is now. The use of human intellect and the need to explain the grasped facts in reality led to theological thinking, which has always complemented the intellectual understanding of the world. Even nowadays science does not provide answers to all questions and leaves room for various kind of explanations based on non-scientific ideologies. These can be in agreement with the achieved stage of knowledge, and so play a positive role in putting together pieces of it; if this is not so, they may hamper its further progress. The priests were guardians of accumulated knowledge and the combination of religion and science was fundamental to the early history of mankind. The close relation of astronomy or astrology and mathematics with religious ideas can serve as an example.

The motives of the ancient mathematicians carrying their studies often very far beyond the simple need of counting people, children, soldiers, crops or money are not known. It seems that sometimes the main motive was intellectual exercise. The role of playfulness in the development of knowledge should not be underestimated even in modern science, as the origin of demography gives a good example. However, the practical needs of governments were the main impulses. Rulers needed to know the population size and therefore population censuses were introduced. They existed in ancient China and Egypt, and their existence can be supposed in all other ancient societies at a comparable level of development. Censuses themselves cannot be considered as the origin of demography. The knowledge of the population size was important mainly for military and fiscal purposes and other information besides that was limited in these censuses.

From the very early times the process of demographic reproduction has been connected with various taboos, prohibitions, orders, rites and ceremonies incorporated into the existing religious system. Their origin can be traced to some practical societal purpose or goal and they eventually became tradition. The reasons for their existence eventually changed, but they survived as a part of the relatively stable religion. The demographic relations of every man follow immediately in importance his need for food and they are equal to or even precede his requirements for security and shelter. There is a mass of information in ancient texts going back to the 3rd millennium BC about married life, relations between spouses and many other forms of marriage, mono-

gamy, polygamy, polygyny, possible divorce and marital faithfulness, relations towards children, old people etc. All possible forms of relations between man and woman have been experienced in the process of demographic reproduction in the past, some of which have proved more advantageous than others in fulfilling the expected goals. The same concerns other orders or habits incorporated in common law, as infanticide, child or human sacrifices, the abandonment of old or sick people, exclusion from society or the population, etc. All these are population policy measures of a given society. They can be complemented by positive measures supporting large families. This shows the importance of facts related to demographic reproduction even before the existence of demography. Such importance has not diminished in modern states and this is the root of demography as a political discipline.

Classical and medieval science, demographic cognition and population policy

Ancient Greece has been considered as a cradle of scientific thinking. Its cultural rise started during the last millennium BC. There are probably many reasons why this evolution started just there, but one of them could be its geomorphological situation. Greece is not a place where the large civilization with millions of people could be developed, such as in the valleys of Tigris and Euphrates, the Yangtze and the Nile. As a result many independent states emerged on the contemporary Greek territory and Greeks achieved an unprecedented high level of individual and societal development. Religion and priests still played a considerable role there, gods were still everywhere, but Greek philosophers and sages started looking for reasonable explanation of events around them; they were not satisfied with myths and magic and they assumed that gods also behave according to certain logic and regularities. Philosophy gradually took the first place in the intellectual development of people previously occupied by theology. The emerging scientific disciplines were not clearly specified and it was common for one person to be interested in various subject matters; Aristotle, for example, was a biologist, physicist, astronomer, physician, mathematician and of course a philosopher, as the new fields of knowledge usually originated inside philosophy. He would also have been demographer if such a discipline had already existed at that time. The number of inhabitants was undoubtedly very important in Greek states at that time as a basis for democratic elections, as well as for fiscal and military purposes. It is very probable that there were not only population censuses, but also records of other demographic events. Such information is important for many other disciplines and practical purposes; nevertheless demography began only when demographic events started to be studied as mass phenomena in their structure and change, and this was not the case in ancient Greece.

Roman science was heavily influenced by its Greek predecessors. Romans were more practical and they built a powerful empire; they did not contribute very much to the further development of scientific thinking, but they knew how to use the knowledge. The Romans are known for their population policy although its effect was debatable; this is not surprising because similar discussions are still continuing. Ulpian drew up tables based on records of deaths, but his attempt too cannot be taken as an origin of demography; the concept of probability was unknown at that time. The counting of deaths and some calculations based on their numbers existed already in Babylonia, but they are even more hidden in remote history.

At the turn of millennia a new religion emerged which influenced subsequent thought in western civilization and consequently the whole world. Christianity adopted Jewish theology and some existing scientific knowledge, but it followed earlier religious practice in explanations of real facts. The effort to understand natural phenomena in their environment and changes was replaced by the will of God expressed and described in the Holy Scriptures, and interpreted by priests. The Church concluded a concordat with the state and became the servant both of the ruler and people. The orders developed by a new theology were very strict. The close relation of the Church and state led sometimes to the sharing of power, often with negative consequences. From the demographic point of view, the Bible clearly expresses the pronatalist ideology common in agricultural societies (be fruitful and multiply). The number of children is a decision of God and families should not alter it.

The medieval world following the fall of the Roman Empire has been characterized as a period of darkness, superstition and hostility to new scientific discoveries. This might be case for philosophy, which was suppressed by theology, and for disciplines such as medicine (e.g. prohibition of dissections), but development did not stop in the use of knowledge leading to new technologies. Medieval architecture and building is only one of many possible examples. At the level of philosophical thinking, the conflict between religion and knowledge was suppressed, as God was the author of both the book of Scriptures and the book of nature (Saint Thomas Aquinas). At the same time, the achieved knowledge of the ancient world was not forgotten. In spite of severe censorship by the Church, old books were rediscovered, copied and distributed, and the ground was laid for a new explosion of science. The service the Church offered to people was also very valuable. The codex of moral and legal norms (canonic law) was developed to regulate everyday life and people's relations among them. The catholic, and later other churches too, also served demography by registering deaths births and marriages since the 15th century.

The almost ideal integration of religion, knowledge, theology and philosophy in medieval society was gradually but inevitably corroded in the process of development. People faced practical problems that demanded practical solutions. Many events announced the coming of a new era. One among the most important was the discovery of the New World at the end of the 15th century. The following two centuries were of great importance as a start of the process which can be described as a global revolution of modern times. Ancient writers were widely studied in what was later called the Renaissance, and many authors contributed to the shift of interest from the Sky to the Earth. Not the Earth, but the Sun is the centre of the cosmos (Copernicus). Discoveries in astronomy were followed by similar important disclosures in other fields of knowledge, moving away from theological explanations and launching the scientific revolution as a part of the global revolution. The growth of knowledge produced new scientific disciplines such as mechanics, anatomy, physiology etc. and the partition of science has continued and is characteristic of modern science up to now. Scientific scepticism and critical thinking gained a foothold (René Descartes) at the same time as scientifically fruitful empiricism (Francis Bacon), replacing scholastic speculation.

Origins of modern science, statistics and demography

Thee time was ripe for new outlooks on reality and for new scientific branches in the 17th century; one of these was demography. Without any previous academic background John Graunt was curious enough to look at the Bills of Mortality of the City of London in a new and original way. In a letter to Robert Moray, one of the founder of the Royal Society of London for the Promotion of Natural Knowledge, and to other honourable members of this Society, reproduced at the start of his *Observations* (1662), he refers to the *Natural History* of Francis Bacon; in all modesty he ascribes his work also to the concept of natural history. Speaking about his practical reckoning or shop's arithmetic, he was not aware of the importance of his scientific contribution, the discovery of mass phenomena. It is not irrelevant that his work *Natural and Political Observations...* was published the same year as the Royal Society was founded. The Academie des sciences of Paris was founded only four years later, in 1666.

It is not surprising that demography was at the origin of statistics or political arithmetic, as it was called at the beginning after the title of the book of Graunt's friend, and probably also adviser and collaborator, the physician, poet and economist William Petty. It was not necessary to define demographic events such as deaths, births and human beings. Studying them as statistical universes, their structures revealed hidden regularities which could not be disclosed in any other way. The scientific world was ready to accept the new methodological approach immediately and three further editions of Graunt's book appeared in a short space of time. Although John Graunt was self-taught, he won scientific recognition and became a member of the Royal Society. Statistics as a universal method opened new horizons in the knowledge of real processes, in research and new branches of mathematics (mathematical statistics, theory of probability etc.). The knowledge of statistical methods gave students of various disciplines new outlooks and original understanding of real processes.

The common origins of statistics and demography had favourable and complicating consequences for both of them. Statistics became a basis for demographic methodology and contributed to the development of demographic analysis. Few other social disciplines have such elaborate methodological apparatus. Demography is not interested in man as an individual being and in his demographic features but in men as a group, in the universe of people or in a population. The collection of information about people is considered as demographic statistics (the process of collecting data and tabulated numerical results). However, demographic statistics provides data which go beyond the scope of demography and obscure its definition. The practical applicability of demographic data for rulers and the state administration has a similar effect. The number of inhabitants, sometimes divided into citizens and foreigners (immigrants), is essential information for a modern state. It is often taken as the population size or a synonym of it. However, one territory or one state can be occupied by two or more human populations, which are more or less demographically separate (mating virtually does not occur among their members) and they have different demographic behaviour (e.g. different levels of fertility). Such examples were frequent in the past and exist even now (e.g. the Romany population of many European countries). It is not important that the different populations living together in one area or state eventually merge in the long run and that state statistics usually do not give demographic data

for different populations but for all inhabitants. Demography has to deal with this, but should be aware of it and use special surveys to complete official state statistical data.

Statistics is usually taken as a methodological or formal discipline without its own subject matter (like mathematics, logic, cartography etc.) in comparison with empirical disciplines (such as demography). However, the regularities that had been hidden when only individual phenomena were studied became obvious in statistical structures. They have a specific ontological meaning but it was two centuries before Adolphe Quételet (1848) recognized their importance. He was greatly impressed by their stability which he saw philosophically as an expression of stability in nature and society. He tried to define an average man and he saw evolution as a tendency towards uniformity and identity of people. In the creation of statistical universes he limited his interest to phenomena of one kind and so he always reached the unimodal symmetric statistical distribution (Laplace-Gauss distribution) which later became the basis for the theory of probability. The refusal to create statistical universes from units of different kinds (qualities) lasted for another century and was supported mainly by statisticians. Only in the middle of 20th century did Jaromír Korčák (1941) demonstrate the natural character of other distributions and show that statistics can be used for any part of reality.

One or more *demographies*

Using statistical methods John Graunt started a trend in demography later named demographic analysis. He came to the conclusion that the number of men and women is about the same in the population, to the estimation of the male-female ratio at birth and to the recognition that people have unequal risks of death. All his findings have a typical statistical character. They disclosed important regularities in facts, but give little guidance for their explanation. After almost 340 years we do not know why the secondary sex ratio is about 106. Demographers do not have tools to solve this problem. This is typical in the process of demographic cognition and there are two solutions: to collaborate with specialists from other disciplines (e.g. with biologists and geneticists in the mentioned case) or to acquire their knowledge. Neither way is easy but both of them lead to a future necessary integration of science.

The recognized inequality of people in the face of death led to the idea of life tables, which became a leading instrument in demographic analysis. Thirty years after Grant's *Observations*, the first life tables were constructed by an astronomer Edmond Halley. Many other authors contributed to the development of demographic analysis. Only few of them can be described as demographers, especially before World War II, when no university had a demographic institute or department. They were astronomers, mathematicians, physicians, biologists, historians, sociologists, economists, geographers, statisticians and others. All of them belong to the history of demography. They were primarily interested in the process of mortality and only later in other fields of demography. At least a few names should be mentioned as examples: Johann Süssmilch, Benjamin Gompertz, William Makeham, Wilhelm Lexis, Karl Pearson, Robert Kuczynski and Alfred Lotka; only recently can representatives of demographic analysis and mathematical demography be considered mainly as demographers, such as Louis Henry, Nathan Keyfitz, William Brass, Roland Pressat and many others.

Many authors primarily tried to explain demographic changes. They cannot be strictly considered only as Graunt's successors. They moved beyond the narrow limits of the demographic analysis and sought to explain demographic processes. They helped demography to mature and become comparable with other empirical scientific disciplines. No such discipline can be based only on its methodological apparatus. Johann Süssmilch saw the explanation of demographic processes as the realization of the will of God. The representatives of classical political economy considered demographic changes as a dependent variable in economic reproduction; population growth is regulated by the law of supply and demand for labour. Thomas Malthus and Karl Marx also belonged to this school; Malthus' famous *Essay* aroused great interest in demographic questions and was heavily criticized, but also praised. Demographic reproduction was no longer a part of economic reproduction but several authors saw economic factors as very significant or even decisive for the explanation of demographic changes (e.g. Edwin Cannan, Harvey Leibenstein, Symon Kuznetz, Joseph Spengler, Richard Easterlin, Gary Becker); their studies were labelled as economic demography. Many other authors placed more emphasis on social variables such as marital status, family, cohabitation, social exclusion, standard of living, level of education, character of occupation etc. Their studies are often identified with social demography (Maurice Halbwachs, Norman Ryder and Louis Roussel as representatives of a long list of authors). Such a division of demography into various parts only shows that the conditions of demographic reproduction are very broad and can be found in any aspect of human life. In the same way other aspects might be underlined and biological demography, psychological demography, psychiatric demography, ethological demography, medical demography dealing e.g. with cases of deaths, ethnological demography, geographical demography, environmental demography, legal demography or even some more *demografies* can be specified.

Different branches of demography have also been mentioned, among them historical demography based on studies of church registrations of demographic events in the past centuries, and prehistorical demography or paleodemography, exploring paleoanthropological discoveries. These are part of demography because demography is already by its very nature a historical discipline, although they can develop a specific methodology (Peter Laslett, John Hajnal, David Glass, Louis Henry). It is important to know about demographic reproduction in the past, even of our biological ancestors, to fully understand its present features. Demographers are also considered as specialists in data collecting data deal with people, such as population censuses, population surveys, registers and registrations. In their capacity as statisticians they are indeed often involved in their planning and organization. As demographers they use their results in the same way as economists, sociologists or any other specialists, for their own purposes.

Demographic data are very important also for the state administration, being the basis for many political decisions. Politicians and administrators are not as much interested in the scientific knowledge of demographic processes as in their economic and social consequences, and in the estimation of future population trends. Population prognoses as applications play an important role in demography; all knowledge gained is used in estimating future trends in mortality, fertility and migration. They are usually constructed in more variants than one, clearly indicating that the future is never precisely predictable. The future cannot be derived from the past because of the possibility that new and unpredictable circumstances will emerge (also our knowledge of the past trends and changes, and their conditions, will be never exact and complete). Many variants

are not convenient for users but they indicate how the prognoses should be applied. Demographers are aware of the limitations of this task and of possible differences from real trends (Alfred Sauvy, Ronald Lee, Nico Keilman) as the past experience has already proved many times.

The interest in the consequences of demographic reproduction can go very far beyond the study of this reproduction itself and it is not possible to find any limits to such endeavour. One example is demographic ageing, but demographic reproduction has similar effects in all fields of economic and social life. All state policy is engaged in dealing with these consequences, in economic and social policy, and in many more specific areas (e.g. population policy, family policy, migration policy and many others). Demographers can provide politicians with the knowledge but they should be aware that there is a conceptual difference between the knowledge of regularities and their conditions, which already exist, and our expectations of what should exist. When they pass the threshold of knowledge, they move into the field of political demography. It is not that they do not have as much right to do this as anybody else, but they should be aware of what they are doing. This is not a problem only for demography; it is even more marked in economy, which is often called political economy. Knowledge is not sufficient for making political decisions; the evaluation of facts and processes is needed, opinion and world outlook are involved and a certain position has to be taken.

Migration is not a part of demographic reproduction. There are two reasons why demographers are involved in studying migration: the statistical registration of migrants is often similar to the registration of other demographic events and it is done by statistical services; and changes in population size are due to demographic reproduction (natural movement) and migrations (spatial movement). Conditions of migration are principally different from those which influence demographic reproduction and they cannot be understood fully without the context of the whole settlement system. Studies of migration from the demographic point of view are limited mainly to statistical analysis; regularities of migration are studied by geographic demography or human geography (geography of population).

Reality is continuous and so it is not surprising that many demographers step over the narrow limits of studying demographic reproduction and deal not only with conditions of this process, but also its consequences, touching on questions of neighbour disciplines, or are involved in policy issues. This is often the case when they research the population development of a certain country, region or the whole world. In the first case it is often not so easy to say if they are still demographers or specialists of some other discipline; for the cognition of reality it does not have much significance because the knowledge itself is important but from the scientific point of view it does, because different systems with people behave differently. In the second case it would be preferable to speak of population studies. There is a long list of authors of population studies and so a few names here should serve more as an illustration than as a weighted selection (this holds for other named specialists too): Warren Thompson, Frank Notestein, Wilfred Borrie, Kinsley Davis, Alfred Sauvy, Ansley Coale, John Caldwell, Massimo Livi-Bacci, Geoffrey McNicoll and many others.

Position of demography among other disciplines

From the axiom that there is only one reality follows the conclusion that there is only one science which reflects on this reality. Whenever one speaks about sciences these are only scientific disciplines. Demography as a scientific discipline studies demographic reproduction as a final process, and in this respect is only one. All studies which pass these limits would be better called population studies. Any part of reality can be studied from different aspects, i.e. by different disciplines. It is important to distinguish reality as an object from the subject matter of any discipline. Man is a part of reality which is studied by many disciplines, but his demographic features and demographic processes as mass phenomena are studied only by demography.

Scientific disciplines are usually classified according to the evolutionary principle which was introduced in the science during the second half of the 19th century and became very important for its further development. According to this, demography can be placed between biological and social disciplines and so considered as a bio-social discipline. The fundamental demographic processes, demographic reproduction, are basically identical with similar processes of other mammals, and they differ only by the social environment in which they occur. The social reality became a second *nature* of man.

In the process of cognition, new disciplines emerge which cannot be classified only according to the evolutionary principle because they encompass elements of different qualities (ecology being one of the most known). By elaborating Korčák's idea based on the ontological meaning of statistical distributions, Martin Hampl (1971; 2000) introduced an equally important principle of structural complexity. Different parts of reality/systems have different levels of structural homogeneity/heterogeneity which can be reflected and measured by statistical distributions. Disciplines dealing with elements of the same quality (any kind of botanical or animal kingdom) create homogeneous systems expressed by unimodal symmetrical statistical distributions and can be identified as elementary disciplines; this is the case of demography dealing with man in the frame of demographic systems. Disciplines studying elements of dissimilar qualities have different level of complexity expressed by asymmetrical statistical distributions; they can be identified as semi-complex disciplines (man as an element in the social systems, e.g. the distribution of incomes) or disciplines with a high level of complexity (man as an element of geographic systems, distribution of migrants according to the distance of moves, regions or communities as elements in the statistical distributions etc.).

Like any other discipline, demography has its internal differentiations. By the most general criteria, four parts of demography can be identified. Completeness (synthesis) and partition (analysis, i.e. of mortality, infant mortality etc.) was applied as the first one. The second criterion divides the abstract and universal (mainly demographic methodology) and the concrete (demographic reproduction of a certain country, infant mortality during a certain period etc.). The abstract includes also what is substantial, essential or general for a certain part of reality, and the concrete what is specific. The confusion of abstraction and generalization does not permit the distinction between demographic theory and methodology (e.g. demographic models are considered as a part of demographic theory, although they should be identified as a part of demo-

graphic methodology). Relations of demography with other disciplines (see below) usually go through a certain part of it.

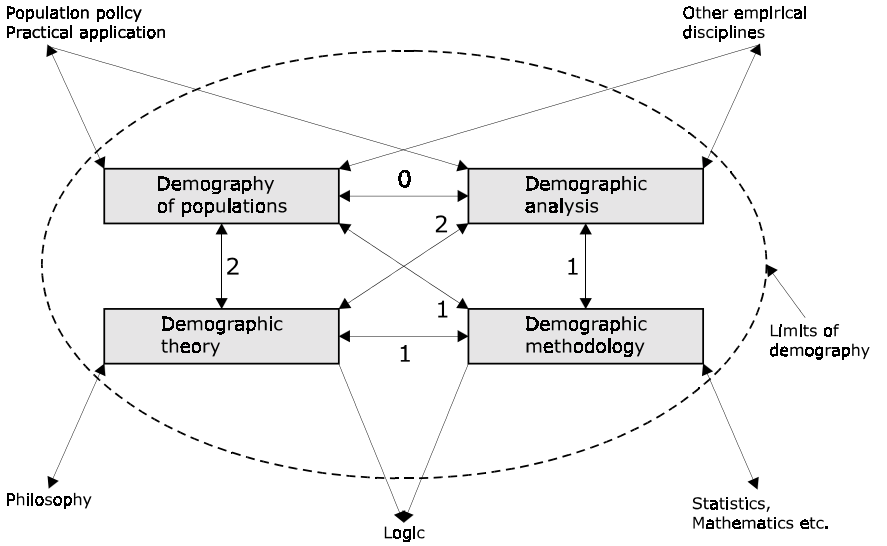

Figure 1: Differentiation of demography and its external relations

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DEMOGRAPHY AND ITS RELATION TO OTHER DISCIPLINES

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Congratulations to the Department of Demography and Geodemography on the anniversary of 100 years of teaching Demography. Some of the early and major contributions to the field of demography occurred in Europe during the 19th century, and it is comforting to see that Demography has had a continuous tradition in many European institutions, and especially at such a historic and prestigious university as Charles University. The Department of Demography and Geodemography is particular noteworthy because its achievements have not only been manifested in many publications, but also because the department is devoted to teaching and education in Demography. Besides a full curriculum in Demography during the regular semester, the department also offers an internationally oriented summer school. Some time ago we looked at the programme and were impressed by both its scope and the prominent persons involved in the lectures.

The celebration of 100 years of teaching Demography at Charles University is an appropriate occasion to reflect on the field of Demography as a discipline, and in particular, the relation of Demography to several other disciplines.

The populations of most of the world's countries are growing older. This shift is creating a new demography, a demography of low fertility and long lives. The rapidly growing populations of the elderly are putting unprecedented stresses on societies, because new systems of financial support, social support, and health care have to be developed and implemented. In this talk today we will briefly touch on some of the health, social, and economic issues arising from the transformation of the demographic landscape across Europe and the world, and we will address the question of how demographic knowledge can affect public policies to accommodate or possibly influence this transformation. We cannot even start, however, to do justice to all the interesting research demographers have done on the problems and opportunities associated with population aging, fertility change and family behaviour in the last decades. So we would like to focus our talk on a particular research thrust, namely those areas of demographic research that are related to the current activities at the Max Planck Institute for Demographic Research (MPIDR) in Rostock.

The challenge to address questions like *What is demography?* and *How is demography related to other disciplines?* is particularly relevant at an institution like the Max Planck Institute for Demographic Research. The research agenda for demography at the MPIDR is not confined by disciplinary boundaries – in contrast to many university centres that are often located within a department of sociology, geography, or a similar field. While these centres frequently focus on demographic research in these particular disciplines, researchers at the Max Planck Institute for Demographic Research enjoy the advantage that they need not restrict themselves to *only* eco-

nomic, sociological or biomedical research. We can transcend these boundaries. This freedom is clearly advantageous in many respects, but it also poses considerable challenges. In particular, we, more than anybody else, need to ask ourselves about the specific strengths and advantages of our discipline as compared to other fields, and we need to establish demography as a field that is distinct from other areas of research but also closely integrated in a wide network of multidisciplinary researchers.

Our vision of demography and its relation to other disciplines is represented in Figure 1. We demographers like numbers, especially censuses and official statistics, and we like calculations and formulas. We like to count and it is our ability to count that gives us insights and influence. We have influence because demography is of great interest to the public and of considerable importance to policymakers. So demography rests on the bedrock of mathematics and statistics but its research findings float upward into the windy heights of politics and policymaking.

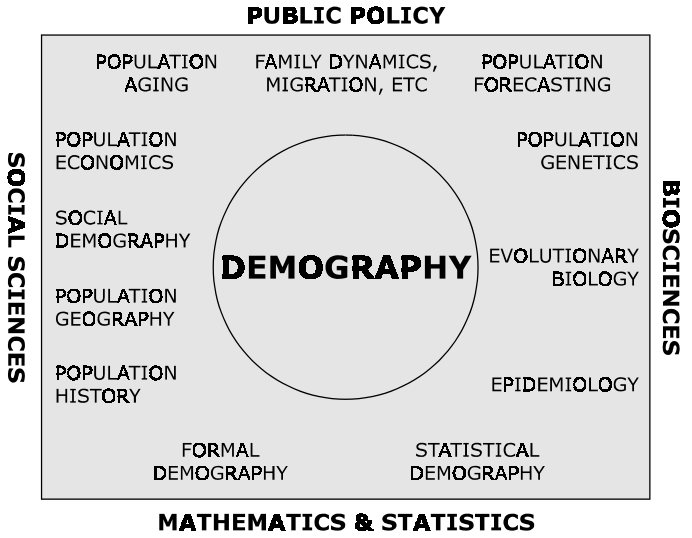

Figure 1: Demography in relation to other disciplines

The models and methods of demography shed light on the structure and dynamics of populations. Most of us are mainly interested in human populations, but Alfred Lotka, Raymond Pearl, and many other distinguished demographers have also had a deep interest in animal populations. Furthermore, the two things we study most – namely fertility and mortality – are quite biological. Hence, as shown in Figure 1, we see demography as lying at the meeting ground between the social sciences on the one hand, including sociology, economics, geography, history, and cultural anthropology, and the biological sciences on the other hand, including epidemiology, ecology, genetics, and biological anthropology.

As indicated earlier, the central questions of demographic research are of immediate relevance for policy makers. For instance, let us turn to the impact of mortality reductions on the growth of the elderly population, specifically the population of centenarians. In the countries with reliable data on centenarians, the number of centenarians is increasing at an exceptionally rapid rate, about 8% per year on average. Demographers are used to population growth rates of around 1% per year or so; an 8% growth rate seems more like an inflation rate. In England & Wales, an average of 74 persons per year reached age 100 between 1911 and 1920; by 1990 the number of people celebrating their 100th birthday had increased to almost 2000 and in 1997 the number was around 3000. The population of centenarians is growing, in part, because of the increase in births a century ago, the sharp decline in infant and childhood mortality, and the substantial decline in mortality at ages from childhood up to age 80. Demographic analysis demonstrates, however, that by far the most important factor in the explosion of the centenarian population – two or three times more important than all the other factors combined – has been the decline in mortality after age 80 (Vaupel and Jeune 1995).

Centenarians are still unusual, but these findings do illustrate the fact that mortality reduction can have major impacts on population growth at older ages and on extending the frontier of survival. The growth of the population of female octogenarians in England & Wales provides another telling example. The remaining life expectancy of 80-year-old females in England & Wales around 1950 was approximately 6 years. Currently the corresponding figure is about 9 years, some 50% higher. As a result, the population of female octogenarians in England & Wales is roughly half as big again as it would have been if mortality after age 80 had remained at 1950 levels. Putting this in terms of population counts, more than a half million females aged 80+ are alive today in England & Wales who would have been dead if mortality after age 80 had not been reduced.

Current family and fertility dynamics are equally striking for many observers. Several European countries are presently experiencing unprecedented low, or *lowest-low*, fertility levels. Countries like Italy and Spain, which are commonly associated with highly family-related and traditional values, are approaching a total fertility rate of one, while many forerunners of the second demographic transition have considerably higher fertility rates. Rather extraordinary changes in fertility and family behaviours have also occurred in the formerly socialist countries. For instance, since 1989 eastern Germany has experienced one of the most dramatic falls in birth rates ever to be observed during peace time in a country. Between 1989 and 1994 the annual number of births in eastern Germany dropped by 60% from 200,000 to 79,000; the number of marriages declined in equal magnitude from 131,000 to 52,000. The mean age of mothers at first birth has increased from 23.6 to over 26 years, and the socio-economic characteristics of parents have changed. If these trends continue in the future, the inevitable results in the so-called New Länder will be a substantial reduction in population size, a rapid ageing of the population, and a substantial shift in the composition of households.

The implications of such a different demographic landscape, independent of whether it is due to substantial improvements of mortality or lowest-low fertility levels, are innumerable: they range from the planning of public services for the young and old, the long-term viability of pay-as-you-go pension systems, the availability and supply of labour and human capital, the level

of national savings, to the demand for housing and other goods and services. Moreover, the question of whether migration can possibly provide an amelioration for these trends is of pressing importance. State-of-the-art demographic knowledge is necessary in order to assess and evaluate these changes in the size and structure of a population, and this knowledge is an important aspect in the respective public policy measures implemented to either influence or accommodate these demographic changes.

Many of these policy measures need to anticipate future changes in the size, structure and composition of the population. Population forecasting therefore is an important tool through which demographic knowledge affects public policy. For instance, Ronald Lee (2000) in a recent analysis of the US social security system argues that the long-term financial outlook for the system is worse than previously thought. This long-run funding imbalance of system is mostly due to the addition of an extra four years to the currently projected increase in life expectancy by 2075. Moreover, Lee argues that industrial countries have a history of under-predicting the growth of their elderly population, and it is expected that large mortality adjustments may also be needed in the projections for public pension programs in industrial countries other than the United States. Appropriate forecasts of population aging can avoid such *surprises* in the future structure of the population, and many policymakers are well-advised to rely on these or similar forecasts in their planning of public and social policies.

In view of this relevance of Demography for the sphere of public policy, it is comforting to look at the opposite side of the diagram in Figure 1: Demography rests on a solid foundation built on two pillars. Firstly, the discipline has theoretical roots in mathematics and statistics, which manifest themselves in the sophisticated areas of *formal and statistical demography*. Secondly, demography has *firm empirical roots* in registration and survey data. Fortunately, both pillars of demography experience rapid innovations which increase the scope and quality of demographic analyses.

Let us first consider data. While we have known survey data for a long time, the availability of large amounts of register-based individual level data is a relatively recent development. Nordic countries have been the leaders in this area, and many of these countries allow complex linkages of individual level information from different registers in order to provide a comprehensive longitudinal picture of individual-level demographic events and their determinants. Although less well-known, similar capacity exists in some countries in Central and Eastern Europe, where, for instance linkages between census and registration data allow for unprecedented opportunities to investigate the recent decline in fertility and life-expectancy. Moreover, the availability of such registration data in the Nordic and some CEE countries considerably enhances the power and scope of demographic analysis in studying rare events, like oldest old mortality, or the demography of small subpopulations. As all of you know, these investigations are usually problematic because small populations or rare demographic events are not sufficiently represented in survey data. Individual level registration data, however, may bring about major breakthroughs in these analyses.

The empirical basis of our research, however, is also expanding in another dimension. Demographers are currently starting to utilize data sources that several years ago were either unknown

or not frequently used. These data come primarily from the biological or medical sciences and are related to the tremendous progress in the ability to collect, store and analyse biomedical information. In the near future these new data will provide demographers with genetic information for substantial samples of the population, results from biological experiments with nonhuman species, or information on special populations like twins.

This availability of new and more comprehensive data is accompanied by advances in demographic and statistical methods to analyse them. To a large extent these methodological advances are related to the rapidly increasing computational power of computers. Anybody following statistical advances must be fascinated by new techniques ranging from non- & semi-parametric statistics, advances in event history models, ability to control for unobserved heterogeneity (with special sample designs, such as twin data or experimental data), but also advances in more traditional demographic methods, like the adjusted total fertility rate that was suggested to augment the standard TFR in low fertility settings.

New mathematical methods for studying population dynamics and the interactions of populations with economic or environmental or social systems also transform demographic analyses and open new areas of investigation in formal demographic analyses. This progress in analysing the interaction of populations with various social and economic spheres is related to improvements in the study of non-linear systems. In order to make such progress available for demographers, the Max Planck Institute for Demographic Research for instance organizes a workshop series on non-linear demography that brings together scholars from formal demography, mathematics and related fields. Nevertheless, despite the progress in non-linear systems, we sometimes encounter situations where the *math breaks down*, i.e., where formal questions are no longer analytically tractable. Fortunately, methods of simulation become more and more commonplace, and we are convinced that simulation will be an increasingly important tool of demographic analysis in the future. The study of social interactions, or the investigation of non-linear interaction in demo-economic systems are just two examples where computer-based demographic modelling is likely to yield substantial progress in the coming years.

It is apparent from the above discussion that Demography rests on a solid foundation of data and methods. Due to the recent progress in these foundations, our discipline therefore is better equipped than ever before to face new challenges. The first challenge, already discussed earlier, is the use of demographic knowledge in the important aspect of public policy. The second challenge of contemporary demography, in our opinion, is the utilization of the opportunities that arise from the unique position of our discipline at the interface of the social and biological sciences. While the social and biological spheres have been quite separate within demography for many years, and most demographers were active either in the social sciences or in the biological sciences, the merging of social and biological perspectives in the study of demographic processes affects some of the greatest opportunities for progress in modern Demography.

Let us first elaborate the more familiar relations of demography to some of the social sciences.

Social demography: This is probably the most familiar aspect of demography to all of us, and we will be quite brief on this topic. In our opinion, one of the most innovative aspects in this area is

the study of interacting populations. Whereas early demographic theory followed structuralistic approaches or modernization theories, like the demographic transition theory, Gary Becker's approach *individualized* much of demographic behavioural theory. While to a large extent we are in favour of this economic perspective, it clearly has major disadvantages. This is not the place to elaborate this in detail, but the breakthrough of an individual perspective is now turning into its disadvantage: in particular, the individual perspective implies that the important influence of social interactions is lost. While there is a substantial amount on data on households and individuals, there is still limited information on data that describes relations between individuals, as for instance through intergenerational transfers or social networks. For instance, is it relevant for our demographic behaviour that we have different social environments/networks, and if yes, how relevant is it? Topics in this are for instance questions of social influence, that is, questions of how our preferences regarding children or marriage or such are affected by *others*, and whether the presence of social interaction has any impact for our interpretation of fertility dynamics.

Population economics: Again, this is a vast field, to which we can hardly pay justice within a few minutes. Nevertheless, let us point out two aspects where population economics is facing new challenges. On the one hand, microeconomics has considerably broadened its scope in recent years, and game theory, behavioural economics (i.e., the boundary of economics and psychology), bounded rationality, had a substantial impact on how economists think about the individual determinants of behaviour. To some extent, however, the microeconomic approaches to demographic behaviour – usually associated with Gary Becker – still need to catch up with these developments. On the other hand, macroeconomics also is facing important new challenges. Two prominent examples are population ageing and the associated problems of transfer systems and health economics, and secondly, the interaction of population, the economy and the environment.

After this brief discussion of important aspects of demographic research in the social sciences, let us now turn to aspects that may be less familiar to you: the relation of demography to the biological sciences.

In mortality**,** the relations between demography and the biological sciences are very obvious. Nevertheless, it was only relatively recently that these questions received systematic attention from demographers. A central question in the contemporary research on mortality is *Why do some people die at 60, others at 80, and a few at 100?* It might be expected that the answers to these questions – and the determinants of longevity more generally – are well understood. A recent review, however, of the determinants of longevity (Christensen and Vaupel 1996) concludes that surprisingly little is known. The chance of reaching age 80 (or 90 or 100) is better for (a) women than men, (b) people born in this century rather than earlier, (c) people born in developed countries, and (d) people who have some favourable genes, such as the ApoE 2 gene (Schächter et al. 1994).

Studies of twins and other kinds of related individuals suggest that about 25 percent of the variation in adult life spans appears to be attributable to genetic variation among individuals (McGue et al. 1993, Herskind et al. 1996). Moreover, recent research at the MPIDR suggests that an additional 25 percent may be attributable to non-genetic characteristics that are more or less fixed

by the time a person is 30 or so, characteristics such as educational achievement, socio-economic status, etc.

While the above findings are quite interesting in themselves, they mark only the beginning of a research agenda: in the near future we will have data from DNA sequencing on a sufficiently large sample population to actually study the impact on specific genes on mortality. In addition, the intersection between demography and the biological sciences is considerably wider. For instance, much research has been done on life-history analysis in nonhuman species and some of this research attempts to address the issue of why there are large intra-species and inter-species differences in life spans. In addition, some genes have been found, notably for nematode worms, that substantially increase longevity.

While in mortality the link of demography to the biological sciences is more obvious, the study of fertility behaviour – which has traditionally been the topic of social demography – can also benefit from looking towards biology. For instance, we have recently looked at whether fertility is subject to genetic influences, looking at data on Danish twins (Kohler, Rodgers and Christensen 2000). On one hand, one might speculate that the investigation of genetic influences on fertility is a dead end. Since *a trait for zero children cannot be heritable*, the fundamental theorem of natural selection would argue that fertility should have relatively little genetically determined variation. Correct; but at the same time, our environment today is distinctly different from our evolutionary environment, and what might have been true in the past, may no longer hold. And surprisingly, this turned out to be the case: cohorts who make conscious choices of their fertility levels, and cohorts who seem to have the freedom to make such choices, exhibit the strongest genetic influences, for instance, cohorts facilitating the demographic transition, and recent cohorts who have most choice in their fertility decisions. This study therefore suggests that the *heritability of fertility behaviour* is not constant. On the contrary, it changes systematically with the socio-economic and demographic context of cohorts. Therefore, understanding the genetic influences on fertility behaviour requires a deep understanding of the socio-economic and demographic context. Thus, it confirms the picture presented here of the discipline of demography being situated between the social and biological sciences.

At the end of this partial and personal overview of how demography is related to other disciplines, we hope that we have convinced you that demographers can contribute a great deal to public policy and other disciplines. Demography is sometimes defined in a narrow way. The concepts, methods, and materials of demography are so powerful and so useful that it seems to us that it would be better for demography to be defined in a much broader, much more inclusive way. Demography lies at the core of the population sciences and demographers can contribute important research findings to many fields. We understand how to study the structure and dynamics of populations. Our knowledge can help us shed new light on the mechanisms driving population structures and dynamics as well as on the consequences of population structures and dynamics. In particular, it seems to us that demographic research will certainly provide new insights and perhaps the crucial insights into the mechanisms that drive the processes of ageing and survival, and similarly, the processes related to fertility, family formation and the human life-course.

Demography, in our view, is based on a solid foundation of data and methods and explores the intersection of the social and biological sciences. Demographic knowledge in the coming years is likely to become increasingly important and influential. Based on these conclusions, we do not see any problems in filling another 100 years of successful teaching and Charles University with an exciting agenda and curriculum. We have no doubt that you will actually do so. Our congratulations once again on your great achievements at Charles University.

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DEMOGRAPHY IN AN INTELLECTUAL CONTEXT: A SUBJECT IN SEARCH OF A HOME

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We are faced with number of questions about demography which it is becoming more important to answer as our subject develops. Some are of a purely intellectual kind; the answers to others are of more practical importance. They may guide the way that the subject develops and the kind of topics in which it is interested. In respect of fertility and mortality in particular, we are facing the challenge of a substantial re-alignment towards biology, genetics and the natural sciences.

Defining demography

I take demography to be *the statistical study of the processes of reproduction, migration and death in the human species, their interrelations with the distribution and dynamics of population, and their biological, environmental and socio-economic causes and consequences.* Empirically we could consider it to be what people who call themselves demographers do, or what *demography* journals present us with. *Population Index* gives a somewhat traditional view of the range of interests. The question was well, if only partially, summarised by Roger Schofield thus: *"a society's demography is a formalization of the risks of its membership"* (Schofield and Coleman 1986, p. 6). A more exciting way of making a similar point might be *"sex, death and passion wrapped in indicators"* (van den Brekel 1999, p. 3). Others more pessimistic, as we will see below, might call demography *a space where other specialists come for a while to do some of their work.* In this paper I will look at demography from a number of angles to see if its *natural home* becomes apparent.

Is demography a discipline or a field of study?

A first question is to ask whether demography is a discipline or a field of study. Although demography has theories and models of its own, both of a mathematical and socio-economic kind, outside the mathematics of formal demography it is extremely eclectic, and multi-disciplinary. Although demography has developed various conceptual frameworks, these form a mosaic rather than a *Gestalt*, thanks to the absence of a central paradigm of explanation (Wunsch 1995, p. 220). Outside formal demography, the theoretical framework typically depends upon ideas and material from sociology or psychology (e.g. the *postmaterialist* origins of the *second demographic transition*; van de Kaa 1997) or economics (e.g. the application of the *New Home Economics* to the opportunity costs of childbearing) or some other defined subject. It is the aim and the object of the explanation (demographic phenomena) which makes the question demographic.

That takes us on at once to the question of what is the subject matter of demography. If theory does not define its scope, then maybe its methods or objects do?

Demography as *object science*

Demography has been described as an *object* science (or topic) defined by its subject matter of vital events and populations, focusing on three individual behavioural domains (fertility, mortality and migration) and their manifestations at the macro level of population, and analysing them according to a broad variety of methods and models. In that way it is different from other behavioural sciences which are interested in causes and motivations of a variety of human behaviour, such as sociology, psychology, anthropology, economics (Dykstra and van Wissen 1999) but analysed by a related set of methods and theories. All these behavioural sciences are deployed in the analysis of interdisciplinary topics which comprise the more empirical area of demography. But demography itself lacks its own means of evaluating these outside contributions. It has to take them at face value and is in that respect unscientific; always a risk for an interdisciplinary topic. Perhaps the distinction is not clear-cut, especially if demography is conceived of as part of biology whose starting point of data is fundamentally biological and concerned with the survival and replacement and growth of populations. Demography is better regarded as a field of study, very wide in its connections, narrower in its aims, rather than a unified discipline.

Demography defined by its hard data – a medium of exchange

Demography is distinguished in the social sciences by the hardness of its (biological) data and attention to accuracy of measurement or of estimation. This demographic *hard currency* can then be used by many other subjects in ways which interconnect. Therefore in some respects demography is basic to social sciences and serves as a medium of exchange between them, and to the biological sciences, inevitably interested in the causes and consequences for individuals and populations of the basic biological events of reproduction, birth and death. But possibly as a result, theorizing in demography is under-developed and papers too often content themselves with technical description and analysis (McNicoll 1992). On this view, demography is the Swiss franc of the social sciences, and demographers are its merchant bankers.

What kind of explanation could be uniquely demographic, which did not fall under the heading of economics or sociology or biology? To an excessive degree, demography has to look elsewhere (Preston 1997). It is always going to the neighbours to borrow ideas (Dykstra and van Wissen 1999) for explanatory models. It is insufficiently assertive about its own intellectual property (Keyfitz 1984) which is handed over to economists and the like, a warning echoed at this meeting by Wunsch, who in these pages insists that demographers must address the consequences of low fertility and long life and not leave them to others. Where does demography stop? If, for example, the main interest is the effect of population on food, then this can be regarded as economic history. If population is the dependent variable, and the interest is on the effect of food upon population, then demography might provide the main framework for analysis.

Central paradigms and problems?

Can any specifically demographic central paradigms and problems be identified, which demography can call its own? These are likely to be either mathematical, or some kind of synthetic interdisciplinary approach. At the core, models of how populations work are the obvious choice, such as stable population theory and its developments into population dynamics (weak ergodicity and the rest), logistic and other models of population growth discussed here by Philipov. These are not unique to the human species of course, but can apply to any non-metamorphic, non-parthenogenetic species with two sexes. On the other hand, a rich variety of mathematical population regulation models in biology, starting from Lotka-Volterra predator-prey models, have had little application to the human species. Certain analytical methods are highly characteristic of demography, pre-eminently the life table (Keyfitz 1985) (including its multi-state forms), and now (we are urged to believe by Dykstra and van Wissen 1999) event history analysis. Multi-level analysis, not specifically a demographic tool, is also making a big impact for isolating contextual influences. But methods do not explain things; they dissect them more completely and put more data in a position to be explained. Murphy (in press) has complained that life table approaches are used insufficiently often to analyse differentials between sub-populations in e.g. in marriage or divorce. The primary focus here, however, is usually the relative levels for the groups studied, not the level of the transition.

It sometimes seems that one of the chief characteristics of demography is that it is not itself; that is, it can only be defined in terms of its component contributing parts, like a multi-cultural society. H.P. Kohler has suggested here that the uniqueness of demography lies in our management ability of other people's disciplines and data. Beyond mathematical models, the demographic *big idea* which may come to the minds of many is the much maligned notion of demographic transition. Whether that is really a *theory* in any scientific sense we will not discuss here. It does at least illustrate the demographic dilemma rather well. There is no part of that set of ideas which cannot be attributed to sociology, or history, or economics. But as a multidisciplinary or interdisciplinary whole it is characteristically demographic, as the focus of all its parts is the explanation of population change. It may be added that preoccupation with change is a characteristic of ideas forged in the last half-century. In the coming millennium, the demand may be more for theories of equilibrium, steady state and regulation (as is more the case in ecological models of animal species).

Many papers, including the contributions to this collection (e.g. that of J. Vaupel) emphasise this multi-disciplinary element, with demography "*lying at the meeting ground between the social sciences... and the biological sciences...* " in an ingenious orthogonal arrangement whereby the social / biological axis intersects a public policy/mathematics and statistics axis (Kohler, Vaupel). The simple diagram at Figure 1 puts the last named, formal demography, in the centre of a three-dimensional structure surrounded by those disciplines which analyse the real world; collectively *population studies*.

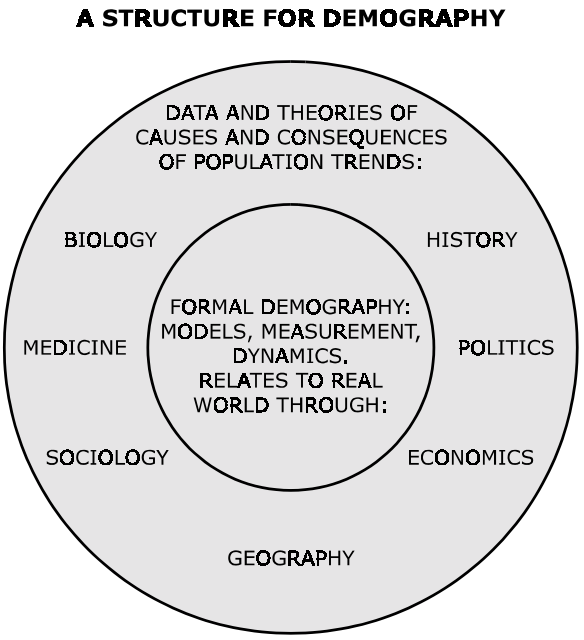

Figure 1: A suggestion for the structure of demography

Technical and causal analysis

The claims of the *life course approach* bid fair to begin a war between the votaries of macro and of micro analysis in demography. Such analyses do not give information about population level implications, nor do they show how one kind of transition affects the rest of the system. Macro analysis, with its emphasis on aggregate data and (for no particularly good reasons) on period effects, is correspondingly disregarded. But as it deals with populations, unlike the life-course approach, the macro level might be thought more intrinsically demographic. The counter-attack of the champions of period effects, while by no means undermining the pre-eminence of life course analysis (which can just as well consider its causal influences in period mode), may nonetheless have some of its theoretical justification taken away if the whole cohort perspective is no longer thought to structure lives as was thought in the past (Ni Bhrolchain 1993).

The life-course approach is offered as a new skeleton or framework for demography, one which considers both the micro level of behaviour and the macro level of cultural and institutional effects on behaviour. *"Foci of life course approach are what population studies are all about"* (Dykstra and Wissen 1999, p. 9). Emphasis on methods tends to provoke numerous displays of statistical virtuosity applied to quite small problems, in part perhaps a product of the emphasis on number-crunching for Ph .D. students. These analyses can take the population out of demography; they do not give information about population level implications which have a dynamic of their own, nor do they show how one kind of transition affects the rest of the system.

Large-scale population theory

This has the potential for being truly *demographic*. On the periphery, demographic transition theory dominates in attempts to account for change, if it warrants that title of theory. Optimum population theory – more oriented to the steady-state – has yet to come of age, if it ever does, but is at least pitched at the population level, and related to models of feedback between the population and the individual and to such models as the logistic curve. Both have obvious forecasting capacities if developed. Were these theories to be really operational, demographic projection would cease to be a theory-free accountancy exercise and become a means whereby demography could present testable large-scale hypotheses.

Below that, steady state or transition theories are ill-connected. There are a number of rival theories which attempt to account for, e.g., fluctuations in fertility in developed societies or the lack of them in absence of transitions (Easterlin, New Home Economics, rational choice, autonomous ideational change, levels of state family support). But they remain ill connected with each other (Coleman and Schofield 1986) and can offer little to explain the *base* level of fertility, especially low fertility, rather than its variability. Migration theory remains in the hands of geographers (where, according to the prejudices of the editors of Population Studies it probably belongs).

Demography may be defined by its outstanding major problems, which may not necessarily be the subject-matter of the majority of papers submitted to journals. I suggest that these major problems include the following. Many are capable of being illuminated by the analytical models discussed above, but not all can be dealt with by small-scale sample surveys:

- the causes of the post-war baby boom and bust and other temporal patterns of fertility;
- is the *second demographic transition* inevitable, affordable or sustainable;
- why intelligent educated adults bother to have children when it is now easy to avoid them;
- the prediction of mortality and morbidity change in developed countries;
- the level at which population growth will stabilize (if at all) in developing countries, and therefore in due course in the rest of the world.;
- the continued existence of feedbacks between population size, growth and composition, and vital rates (i.e. is there still a micro/macro homoeostatic model which will lead us to expect stability in future vital rates and population growth).

The structure of demography

The structure of demography may help to answer some of these questions. Demography has been described as being arranged in a sphere with a hard mathematical core and a softer socio-economic and biological rind (Figure 1). The core represents the technical property of demography in the form of mathematical theory and techniques of measurement. This core touches the surface of the real world only through specific populations whose behaviour needs to be explained. An outer rind of theory and fact, derived mostly from other subjects, is deployed to explain the causes and consequences of that population's behaviour through biological, historical, political, sociological and economic processes. Little of the detail of this outer explanatory structure can

be regarded as the unique property of demography, but perhaps the multi-disciplinary combination of them can be. Preston (1997, p. 233) puts it somewhat differently. He defines demography as it is reported in the pages of the journal *Demography* in the 1990s as comprising one core and four satellites. The core, the *fundamentally unique feature* is a set of demographic techniques, measures and models including biometrical approaches shared with actuarial science and population biology. The satellites are the collection and evaluation of demographic data; studies from various disciplines on the causes and consequences of population change (*population studies*), descriptive studies of variables such as poverty, living arrangements, marital status etc (*social demography*) and analysis of household and family behaviour using an economic maximization paradigm (*economic demography*). These are not necessarily *permanent fixtures*. For example the meetings of the Population Association of America over 15 years show a dramatic turnover in topics, and a high proportion of participants only temporarily donning demographic clothes. Population researchers, Preston concludes (1997, p. 237) are not practising settled agriculture but hunting and gathering.

Is demography a science?

Again the answer is rather a partial and uncertain one. Demography sometimes aspires to be a science and has some of the characteristics of a science – conceived as a natural science rather than the looser definition of social science. That becomes easier to accept if demography is regarded as a form of applied human biology.

Demography certainly possesses some attributes of a science:

It is numerical, analytical and concerned with hard biological events. Numerical approaches, presenting and analysing data in numerical or graphical form or in the form of algebraic expressions, are of its essence. Demography without numbers is a bland form of social or historical waffle.

It depends on actual measurement of empirical material.

It has a technical, numerical *core* area of a semi-biological type.

It is reductionist, seeking to explain (however unsuccessfully) complex systems in the most parsimonious way. At its best it proceeds in a hypothetico-deductive fashion, putting up propositions to be tested against evidence. In these respects it may be no different from (e.g.) empirical sociology and less scientific than economics. But it also has some of the peculiar *un-natural* nature of natural science emphasised by Lewis Wolpert (1995). It attempts (so far with indifferent success) to predict future events on a rational and testable basis.

For example it tends to make its early pioneers obsolete, and to displace and forget earlier theories. Unlike classical sociology or anthropology today, demography has no late 19th century culture heroes whose works are still central to the teaching curriculum or to research. On the contrary, works more than ten years old are seldom read.

It also has an *un-natural* tendency to generate counter-intuitive solutions, for example the concept of demographic inertia, the effect of longer expectation of life in populations with e^0 less than 60 to make those populations younger not older, the surprisingly weak effects upon life expectancy of the elimination of cancer, the inability of immigration to halt population ageing, the absence of effect upon the sex ratio of stopping childbearing when a child of given sex is born, the dependency of favourable dependency ratios only on the birth rate.

Outside the technical realm we might add such examples as Catholic countries (Italy, Spain. Portugal) which now have the world's lowest birth rates. Most traditional societies do not practice birth control, yet none have even half the maximum possible average number of children (16). Up to the beginning of the 18th century, about ¾ of adolescent men, and ½ of women spent some years away from home working as *husbandry servants* in the homes of non-relatives away from their hometown or village. For centuries, West Europeans have married late, lived in *nuclear* families and often avoided marriage altogether.

However, against these perhaps unexpected findings must be placed the weak predictive ability of demographic theory, whether expressed in demographic transition theory or in the more technical form of population projections. Furthermore its explanatory models place heavy emphasis on sociological, economic, psychological factors which are not its own *property*.

We are also left with too many serious unsolved general problems, some listed above, which militate against a scientific basis for the subject: these include old yet unsolved questions such as: Why are birth rates falling in some poor countries while they continue high in other, equally poor ones? What common features were behind the initial declines in fertility and mortality in the 18th century? Why do adults in modern societies continue to have children when they bring only substantial material disadvantages? What mobilizes some residents in poor countries to attempt to migrate to the West, when their neighbours stay put?

Disciplinary connections – demography's kin

Genetics, biology and psychology

As regards the disciplinary connections of demography, those with sociology and economics and applied mathematics are obvious, those with biology and population genetics are less so, given the predominance of social explanations. But they have long historical roots in both directions which are now coming to the surface. In the United States, demography alone of the social sciences secures much of its funding from a biomedical source, the US National Institutes of Health. The biological nature of basic demographic events needs little emphasis. The salient position of demographic notions in Darwinian thought and in the formulation of the genetical theory of natural selection by R.A. Fisher in 1930 are well known (demography + genetics = evolution). Mathematical models of population structure, dynamics and regulation are shared with biology. These connections, out of favour since the 1930s, are rapidly re-establishing themselves in the 1990s in new ways, at each end of life, as biological science comes of age, possibly to revolutionize the 21st century. New research on maximum age at death is focusing attention on its genetic determinants and evolutionary function. The study of the high level of voluntary

childlessness in many European societies, the continuation of low fertility, and the converse puzzle of explaining the continued reproduction of couples who thereby incur serious material disadvantage (Coleman 1999), has focused attention on biological determinants of human demographic motivation. At the same time human genome research, behaviour genetics and twin studies, and the attempts to account for reproductive strategies in simple societies according to biological models are strengthening the biological influence on explanations human reproductive behaviour. As premature causes of death diminish in developed societies, attention is increasingly focused on the issues of senescence and the survival of the oldest old, where human genetical potential and variability inevitably have more explanatory power. In that synthesis may lie the future of demography as a quasi-science or even a real one.

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DEMOGRAPHY: A DISCIPLINE SOMEWHERE BETWEEN PHILOSOPHY AND SOCIAL CARE

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Most demographers would agree upon the fact that the origins of demography date back to John Graunt's *Natural and Political Observations upon the Bills of Mortality*, published in 1662. This study does not only deal with mortality as it is well known, developing the concept of the life table, but it also considers such matters as the number of fertile women, the total population number, and the age structure of the population (Leridon and Toulemon 1997). The origins of demography are therefore linked to the development of actuarial science and of statistics. Indeed, some classic books on demographic methodology, published half a century ago, such as Wolfenden's *Population Statistics and their Compilation* (1954) were in fact written by actuaries or statisticians. Even today, some well-known demographers, such as Jan Hoem or John Pollard, have published both in actuarial science and in demography, and some great statisticians such as Leo Goodman have written seminal papers on the stable population model. There were also the considerable achievements of such well-known figures as Gini or Lotka before World War Two.

Demography cannot however be reduced only to its methods and techniques, even if our science has indeed developed a methodology quite unique among the social sciences. British political economy during the last century has, for example, largely dealt with population issues, and the pros and cons of Malthus' work and that of his followers have fuelled a lively debate among demographers ever since. Demographers have therefore also been highly involved in policy issues, either taking a stance against the dangers of a declining population or on the contrary leading the fight in favour of family planning, and of maternal and reproductive health in Third World regions. In some countries, such as in France, the fear of denatality has fostered the growth of official population research centers such as the INED. In others, the population explosion in the developing countries has associated demography with population control, especially as donor agencies such as UNFPA have financially supported large programmes in this field. This has led among other things, to an enormous increase in the amount of information available in the developing countries on fertility, family planning, and mortality.

It is my contention that these two broad axes, methodology and population policies, along which demographic research is largely pursued at the present time, are stretching the limits of demography from e.g. philosophy to social care. I will support this proposal by drawing upon my own experience in the field of methodology on the one hand and of population ageing on the other hand. In the field of methodology first of all, consider for example those two old warhorses, standardisation and the problem of competing risks. Both problems actually have to be understood in the framework of a causal model considering the type of relationships between the variables involved and the possible impact of hidden variables on the system. The causal nature of

these problems inevitably raises the important philosophical issue of what causation is, particularly in the social sciences. This even led me to write a book in 1988 on *Causal Theory and Causal Modeling* from the viewpoint of the social scientist I am, and not as an amateur philosopher – even if I obviously had to read the relevant philosophical literature on the subject. I do not conclude that all demographers should subscribe to the journal *Philosophy of Science* but I do stress the fact that philosophical questions cannot be disregarded when trying to explain demographic processes.

Other philosophical questions arise once we discuss the role of time and the ordering of events, or when we wish to develop more or less general explanations of such processes as demographic transition. For example, are there *laws of nature* in the social sciences which are more or less universally valid? Probably not: our explanations would therefore be time and space dependent and would need to be constantly renewed. If this view is correct, the *End of Science*, which is of concern to some philosophers and scientists in the domain of the natural sciences, is unlikely to happen in the sciences of man... and woman. Similarly, when we deal in demography with such matters as life and death, we cannot avoid considering ethical issues. Once again, demographers do not all have to become specialists in ethics but they should not be afraid to confront problems of an ethical nature when required. We demographers should at least take part in the debate.

Let us now have a look at the second axis of research, population policies. These policies should not only be restricted to fertility as they often are, but they should also consider other demographic components such as migration and mortality. Considering the latter, mortality, with the increase in life expectancy and the ageing of the population, all our societes are or will be confronted with the problem of old-age mortality and morbidity. With the changes in age structure, more and more people are both old and disabled. Furthermore, increases in life expectancy do not necessarily lead to progress in healthy life duration, though this question is still being debated. My own research on the maximum expectation of life has recently led me to consider diseases of the aged and more particularly old-age dementia (Gourbin and Wunsch 1999). A disease such as Alzheimer's (AD) raises various problems of a demographic nature: What data are collected? Are they comparable over time and space? How do we measure the prevalence and incidence of the disease? Except in the later stages of the disease, many patients with AD are never sent to a hospital or clinic and are therefore excluded from official statistics on the disease. Who therefore takes care of the patient? By whom has the disease been diagnosed? Can some information be derived from the social security system? Demography has therefore led us to deal in this case with the health care and social care systems in Europe, both intra and extra muros, in order to obtain data on the number and characteristics of AD patients without having to conduct a population-based survey.

My own interests in demography have therefore led me from philosophy to social care. My case is certainly not exceptional, and more and more demographers are working at the frontiers of traditional demography. As the borders of demography are expanding, due, among other factors, to the fact that demographers are more and more aware of the *causes and consequences of population trends* (to quote the title of a famous book from the UN Population Division), it will be necessary for population science to brush shoulders with an increasing number of disciplines

and related topics. This does not mean losing our specific character, as demographers, nor abandoning our principles of objectivity and of value neutrality which are at the very basis of the scientific endeavour itself, nor taking sides as scientists in political debates, but it does mean becoming more involved in the assessment of the social impact of population trends and in showing how our science can throw light on contemporary social problems[1]. If demographers do not study these problems, others from other disciplines will do it, with one possible result being the implosion of demography as a science.

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[1]Problems of care for the aged, of exclusion and health, of the integration of migrants and displaced persons, of adolescent fertility, of sexually transmitted diseases, of ethnic and gender inequalities, of living arrangements and the diverse reality of family life, of city life and urban restructuring, of population–environment–development relationships, of population and human rights, ...

DEMOGRAPHY – ON THE NEED FOR INTEGRATION AND SYNTHESIS

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On specialisation and the flow of information

Increased specialisation is one of the most dominant characteristics of scientific research in the post-war period. In demography this trend is also clearly visible. The remarkable increase in the number and range of population journals is a telling illustration of that phenomenon. Three well known demographic journals have now existed for more than half a century: *Population, Population Studies,* and *Genus.* And, even though migration was never a favourite topic of the editors of *Population Studies,* all three journals catered, in principle, for the whole field of population studies and for all regions of the world. The *Population Bulletin* of the United Nations, and the *Population Bulletin* published by the Population Reference Bureau (1945) are equally long-standing and broad in orientation. Later additions to the range of journals demographers consult regularly, have on their shelves, or follow through abstracts in the *Population Index* or a similar bibliographic source, have tended to be more specialized. The *International Migration Review* (1966) and *International Migration* (1962) address a fairly specialized audience. *Family Planning Perspectives* (1974) and *Studies in Family Planning* (1969) also reflect a clear focus in their title; they mainly aim to reach readers concerned with population change in developing countries. The name *Population and Development Review* (1975) suggests a similarly restricted orientation, but this journal has evolved to become one, if not the most prestigious journal in the whole field. Readers with a specific interest in the biological aspects of the discipline will normally read the *Journal of Biosocial Science* (1968) and *Social Biology* (1953), while for economic demographers the journals of *Family Welfare* and *Population Economics* (1987) are of prime importance. Other (comparatively) recent additions are, again, highly specialized: *Mathematical Population Studies* (1989), Population *and Environment* (1978), and the *Health Transition Review* (1990) are good examples. Historical demographers, demographers who concentrate on marriage, cohabitation, and the family, and even those who combine family and history, similarly have their own means of communicating. Some of these have a long tradition (*Journal of Marriage and the Family* 1938), others are more recent and reflect the further specialization I describe (*Journal of Family History* 1975; *Journal of Family Issues* 1979). Where demography touches upon public health, gerontology, epidemiology, sociology, anthropology, psychology, policy making or politics, human resources, labour force, refugees, ethnic relations, urbanization or prognosis, other relevant journals invariably exist. It should, finally, be noted that every self-respecting country tends to have its own population journal, and that a number of other, internationally important journals, such as *Demography* (1963), the *European Journal of Population* (1984), the *Journal of the Australian Population Association* (1983), and the *Notas de Población* (1972), although they are broadly focussed substantively, have a strong regional orientation.

This impressive array of potentially relevant sources of information, has turned attempts to synthesize substantive knowledge on a certain topic or region, into a quite hazardous undertaking. Such attempts, moreover, usually lie well beyond the means of a single person. As a result they most commonly take the form of edited volumes based on the proceedings of a small conference or workshop, or a more prolonged effort conducted by an institute or other organisation. Amongst those with a regional orientation, I would like to recall *The Demography of Tropical Africa* published by Brass et al. in 1968, *The Decline of Fertility in Europe* edited by Coale and Watkins (1986), and of a much more recent date *The Revolution in Asian Fertility* (Leete and Alam 1993) and *Europe's Population in the 1990s* (Coleman 1996). Important thematic work was sponsored by funding agencies with a strong stake in a particular issue. *The Role of Surveys in the Analysis of Family Planning Programs* (Hermalin and Entwisle ca. 1981), and *Determinants of Fertility in Developing Countries* (Bulatao and Lee 1983) are good examples of this type of work. *Migration Decision Making* (De Jong and Gardner 1981), *Marriage and Remarriage in Populations of the Past* (Dupâquier et al. 1981), *Determinants of Fertility Trends: Theories Re-examined* (Höhn and Mackensen 1982), and *Family Demography. Methods and their Application* (Bongaarts, Burch and Wachter 1987), are examples of collections of essays with a primarily scholarly focus, but which, again, aimed to review the state of knowledge by means of a more or less comprehensive set of individual papers. Several of the demographic journals just discussed have contributed to that type of overview by publishing special supplements.

On integration and synthesis

In most edited collections the integration of findings leaves a great deal to be desired, although the editors do on occasion provide a good introductory chapter. Books which contain an overview and interpretation given by an individual scholar, customarily have the advantage of being well structured and of being coherent in terms of the perspective chosen. While one may not agree with that perspective, such works tend to be influential and comprehensive, and thus have merit as a source of information to which one can return time and again. Sometimes they are quite controversial and stimulate debate. Shorter's *The Making of the Modern Family* (1977) and Chesnais's *La Transition démographique* first published in 1986, are but two examples of a list which is not that long and which comprises studies that are controversial and have stimulated a good deal of debate.

Notwithstanding all such laudable efforts, one may make the case that under current conditions the lack of integration and synthesis is beginning to hinder the development of demography as a discipline. This partly because within the discipline scholars tend to focus on a quite limited area and tend to write exclusively for other such specialists; and partly because it makes demography less relevant and accessible to other social science disciplines. I am not the first to draw attention to these phenomena, but feel I have good reasons to raise these concerns again. In a recent study about the way demographic knowledge travels, van Dalen and Henkens (1999, p. 247) have shown that specialized demographic journals scarcely communicate with one another, They play a very modest role in the construction of demographic knowledge. The bulk of knowledge is created in the major general journals (particularly the US-based journals). From there it trickles down to other regions and to the specialized journals. Language barriers are serious.

It is, further, a source of continued concern to me that so little effort goes to achieving a deeper understanding of the remarkable demographic changes which developed countries have been experiencing since the mid-1960s. While studies dealing with specific aspects of family formation, mortality and migration abound, there is very little effort to see these three determinants of growth in relation to one another. Moreover, while for each determinant there are detailed investigations relating to individual variables such as extra-marital fertility, cohabitation, voluntary childlessness, survival at advanced ages, or the employment opportunities of migrants, there appears to be a lack of integration of knowledge within such broad areas. In turn, this makes it impossible to judge with confidence whether we are dealing with a temporary state of affairs or a situation which is more permanent. In a guest editorial in press in the European Journal of Population I shall make a plea to launch a new European Transition Project to address these shortcomings. It is, first, desirable to investigate whether current demographic conditions have anything to do with the stage that European civilization has reached. It is, secondly, necessary to assess the extent to which the demographic constellation to which Lesthaeghe and I have given the name the Second Demographic Transition reflects the stage of (socio-economic) development of the industrialized countries. And it is, finally, essential to relate the findings of demographers about demographic trends in the last 25 years or so to the findings of other social scientists who appear to encounter similar problems of integration and interpretation. Given its strong empirical base and careful measurement demography is well placed to provide other disciplines with insights which may help them in reaching a synthesis. Rather than merely *borrowing* ideas from neighbouring disciplines, demography should aim to be an important source of ideas and integrated results for other social scientists.

On the interpretation of the Second Demographic Transition

In a public lecture for a very mixed audience of scholars and scientists I recently gave at my former institute, NIAS, I have attempted to raise interest in the question of the interpretation of the series of interlinked demographic changes we have come to call the Second Demographic Transition (van de Kaa 1999a). The description of events and long term trends is not in contention (van de Kaa 1999b). The crucial point is whether we should interpret the current demographic constellation as a temporary phenomenon or a permanent feature of advanced industrial societies?

If the trends during the last 35 years or so can be interpreted as a temporary phenomenon, there is no reason for concern. If the conclusion is that these trends and conditions reflect a permanent feature of our societies, we may have to look much more closely at its long term consequences. There is little I would wish to add to what I said in my NIAS-address. So, in what follows I shall, where appropriate, quote myself. Demographic changes depend on structural, technological, and cultural factors. It would seem that the recent changes are closely linked to value changes in society. Thus, internationally it is especially Inglehart's comparative work on value changes which is important. In a series of very stimulating comparative studies he has argued that as the modernization process progresses, the emphasis on survival and economic achievement as the top priority will give way to an emphasis on the quality of life. In his words: "..., *the disciplined, self-denying, and achievement-oriented norms of industrial society are giving*

way to an increasingly broad latitude for individual choice of lifestyles and individual self-expression" (1997, p. 28). He characterizes that shift as one from *materialist* values (economic and physical security) to one of *postmaterialist* values (individual self-expression and quality of life). For a number of Western European countries the shift to postmaterialism has been well documented through repeated surveys. While his measurement instrument has been criticized and may be a bit sensitive to temporary disturbances, the long term trend is pretty clear. Postmaterialism is on the increase.

In his most recent publication Inglehart has introduced a somewhat different concept which he calls *postmodernization.* He posits it as a wider concept than postmaterialization, and describes it as follows: *"The shift from Materialist to Postmaterialist priorities is a core element of the Postmodernization process"*(op. cit., p. 35). He, further, argues that the conceptualization underlying the materialist-postmaterialist debate is outdated since that shift is only part of a *"... much broader cultural shift"*. Inglehart assumes that modernization has run its course. To quote the most pertinent passage: *"In the past few decades, advanced industrial societies have reached an inflection point and begun moving on a new trajectory that might be called 'Postmodernization'. With Postmodernization, a new worldview is gradually replacing the outlook that has dominated industrial societies since the Industrial Revolution. It reflects a shift in what people want out of life. It is transforming basic norms governing politics, work, religion, family, and sexual behavior. Thus the process of economic development leads to two successive trajectories, Modernization and Postmodernization. Both of them are strongly linked with economic development, but Postmodernization represents a later stage of development that is linked with very different beliefs from those that characterize Modernization. These belief systems are not mere consequences of economic or social changes, but shape socioeconomic conditions and are shaped by them, in reciprocal fashion."* (op. cit., p. 8).

"It is, obviously, very tempting to postulate a direct relationship between the process of postmodernization and the advent of the Second Demographic Transition. I am convinced such a relation exists. However, numerous spirited discussions... have made me aware of the confusion, controversies, and sensibilities surrounding the term 'postmodern' and its various derivatives. I hasten to add, therefore, that from reading the book that Bertens (1995) wrote ... on the history of the idea of the postmodern, I have deduced that two dimensions could possibly be demographically relevant. The first is to conceptualize it as a Weltanschauung or Zeitgeist, the second to conceptualize it as a new historical era. Major changes in worldview have been documented for the past, and historians have also described major transformations in which one historical period shifts to the next. One should expect such major changes to continue to develop, and I find it a rather stimulating idea that such a shift may have occurred during my life time. Let me stress further that in considering that issue, postmodern theorizing per sé has almost no role to play. The point is not whether people subscribe to some sort of postmodern credo, which in any case, does not exist. The point is whether their outlook on the world has changed in such a way as to reflect postmodern concerns and notions. That is, whether their belief in the metarécits, the meta-narratives which legitimize and underpin the modern period, has substantially diminished. To phrase it more specifically, whether their belief in, for example, societal progress, in the superiority of the white race, in the value of the nation state and its sovereignty, in the benefits of all sorts of scientific enquiry, in religion, in the wisdom of the

political elite, and in authority more generally, has largely evaporated. Numerous arguments that this is the case can be advanced. Admittedly, formulating counter arguments is not particularly difficult either."

In trying to understand the current situation better, one may also go back to a discussion which once was very popular amongst historians, but now is almost forgotten. It is the discussion about the rise and fall of civilizations. It has frequently been argued that, viewed in a long term perspective, civilizations pass through a series of distinct stages. Caroll Quigley (1961) has listed these as follows:

1. Mixture
2. Gestation
3. Expansion
4. Age of conflict
5. Universal Empire
6. Decay
7. Invasion.

If one posits the existence of a Western civilization under which the European is then subsumed, that civilization would seem to have advanced well into stage 5. In Carroll Quigley's characterization of that stage, parallels with current experience are easily found. It is a period of peace and of relative prosperity, with peace arising from the absence of competing political units and prosperity from the reduction of trade barriers and the ending of belligerent destruction. Vested interests have triumphed and are living of their capital (Quigley, op. cit., p. 88). The civilization has reached a peak. Complacency sets in. Investments in the future decline.

"Is it too far its fetched to see postmodernization as an expression of that stage? And, consequently, to see the Second Demographic Transition, with its unprecedented low levels of fertility, rapid ageing, and strong immigration, as a manifestation of a rather permanent state of affairs? Must we further conclude that Europe's demographic future is a thing of the past?" ... "In the polite scholarly discourse of our time, posing such far-reaching questions is usually characterized as courageous or ambitious."

One deals with them at one's peril. It is sensible and prudent to avoid them.

"Nevertheless, they are entertaining and it is pleasant to reflect on the window one's own life provides on the long succession of generations. When looking out, it is not difficult to list arguments in support of the idea that the current demographic situation is rather permanent and simply reflects that the Western civilization and European region are past their peak. The process of de-colonization has greatly reduced Europe's influence in the world. Europeans cannot keep their own house in order, they rely on a dominant US to do so. There also is the tendency to assume that future generations cannot possible be so well off as we are now. Conservation seems to be of greater concern than creation. Providing social safety nets or 'cushions' of one sort or another is the occupation of many. Pictures of the future are painted in the darkest colours van Gogh ever had on his palette. Greenhouse gases cloud the sky; rising waters

threaten vast areas. And, is it too much to observe that Europe's demographic future will already be largely determined by people living outside the region? Will not multicultural societies develop as a result of continued immigration and affect the cohesion of the European civilization?

It is equally simple to draw up a list of arguments which testify to Europe's vitality and undiminished vigour. The establishment and extension of the European Union is a prime example. It embodies the ideals of the European civilization at its best. The creation of the Euro zone also is not suggestive of a region that does not believe in its own future. Moreover, will not the information revolution enrich the life of future generations beyond comparison. Easy access to the heritage of a whole range of cultures will offer unprecedented opportunities to the most gifted and to the population at large. Immigration will contribute positively, just as in the past, it will lead to new initiatives and activities. And, can anyone deny that, under current conditions, limiting reproduction and population growth is not a very sensible strategy?"

Where does the balance lie? In such a discussion demographers are apt to point immediately at Europe's past. And, past concerns about Europe's long term demographic future have not turned out to be well founded. During the economic crisis of the 1930s fertility fell below replacement level. Fear of a depopulation of Europe and the consequences of a declining population were commonly expressed. But, fertility rose again and after World War II a baby boom led, in fact, to concerns about the consequences of rapid population growth. Concerns which evaporated, equally unexpectedly, with the Second Demographic Transition. If one goes back in time a little further, one's scepticism about our ability to project long term trends accurately is both tested and strengthened. As my Amsterdam colleague Henk de Gans rediscovered, in 1905 a Swedish professor of Political Science, Pontus Fahlbeck, addressed the members of the International Statistical Institute on a topic, which would, as he said, appear to many *"... insolite et même un peu bizarre"*. The issue, as you may have guessed, was: *La décadence et la chute des peuples*. The First Demographic Transition had just begun and he reviewed the experience of other civilizations to see whether he could establish some sort of law which predicts that demographic decadence inevitably follows their expansion and then leads to their fall. He concludes that it is wrong to transpose the life cycle of an individual human being to that of a population. However, he was uncannily correct in predicting the current situation where families with 1 or 2 children predominate. There were no women in the audience and apparently he got away with the following formulation: *"Les femmes aiment les enfants, mais elles n'aiment pas à en faire, et si elles sont libres d'agir suivant leur goût, les familles de deux ou même d'un enfant deviennent la majorité"* (Fahlbeck 1905, p. 387). He rounds his speech off with the sentence that the *fatal decline* in births has begun its work and that not a single mortal can predict where it will end.

"Can demographers do better now? Not much I'm afraid. The great problem lies in our inability to explain the Second Demographic Transition as a temporary disturbance. Are we simply observing the consequences of the fact that our societies are not well adjusted to the needs and desires of its citizens? If so, the demographic disequilibrium which has developed will, no doubt, lead to a reaction which will ultimately bring the fertility level in balance with mortality again. If women and men now find it difficult to combine the parental role with their career, achieving gender equity provides the logical answer. And, if societies really find children impor-

tant, let them shift support from the aged to the young. Surveys show that women still see the two-child family as their ideal; they now try to have them later than before. But, basically, nothing much has changed.

Such arguments may well have some truth in them, but do not sound terribly convincing. In Eastern Europe, the new countries in particular, crisis conditions certainly play a role. However, in quite a few other European countries fertility has been below replacement level for more than 30 years now and shows no signs of rising again."

It is the combination of our inability to provide a satisfactory explanation for the current situation with the perfect way in which recent trends fit a long term pattern, which makes me wonder whether we can look at Europe's demographic future with equanimity. I feel that, at the very least, this is the time European demographers should work together and devote a greater part of their energy to synthesis and the integration of their findings.

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HISTORY OF DEMOGRAPHY

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When Jacques and Michel Dupâquier published, fifteen years ago, the first – and only! – history of demography, they put on the title page of their book a famous citation from Auguste Comte: *"On ne connaît pas complètement une science tant qu'on n'en sait pas l'histoire"* (Your knowledge of a science remains incomplete as long as you remain ignorant of its history). And in this round table, Hans-Peter Kohler advocates that demography is located at a crossroads between policy problems or concerns and *pure* mathematical science, between the urgent need to understand social mechanisms in order to manage them and the more *gratuitous* advancement of science.

I will try to show that it is through this permanent tension that demographic analysis made its successive developments through its history. And we may be surprised to discover in the history of demography most of the fundamental questions that we are raising today.

It is widely acknowledged that demography was born in London in 1662, when John Graunt published his *Natural and Political Observations on the Bills of Mortality*. But the origins of some parts of demography are more remote, especially as regards data collection. Censuses are almost as ancient as societies. Their aim was not demographic in the strict meaning of this modern concept, but more generally fiscal or military. In empires where it was officially said that *the power of the king is measured by the number of his people*, the enumeration of the population would have been motivated by a pure demographic intention (as was possibly the case in China). But in fact, the real motive behind most ancient censuses was the prospective evaluation of tax returns and potential size of the army. The initial question was: *Can we declare and win the next war?* The censuses did not aim to count the whole population, but only those parts of it that would contribute to the answer. Censuses were never exhaustive, and figures were typically weighted by various political, religious or ideological considerations. The census registered not only quantities but also qualities of people.

As regards vital events registration, it can be traced back to the 14th century, when the Christian Church began to keep records of baptisms, marriages and burials. The original purpose was to keep written evidence of important facts in individual lives. It is not before the 18th century that the parish registers were used in the whole Christendom and kept in a standardized form. In the first years of the French Revolution, this system was extended to the whole population regardless of religious affiliation.

The founder of demography, John Graunt, took advantage of another kind of vital events registration: the London bills of mortality. These little bills were posted every Sunday on the door

of all churches to inform people of the proportion of deaths imputed to the plague in the preceding week. It was an epidemiological concern. Graunt, prompted by pure scientific curiousity, wanted to derive general laws from long chronological series of such bills, and for that purpose he constructed principles of statistical approach and the main tools of statistical description and analysis. Because the field of application was vital statistics, he simultaneously invented demography. His very simple calculations (frequencies and proportions) are the actual origins of our modern means and rates. He was also the inventor of data quality evaluation and correction.

One important incentive in the development of a science based on statistics, such as demography, is the availability of statistics. But it is one original pattern in the development of demography that conceptual and methodological steps were often taken before the necessary statistics became available. Graunt designed the model of a life table, with deaths and survivors at successive ages, and this is all the more astonishing in that the statistical data that could have allowed him to compute an actual life table did not yet exist!

After this initial step, the first demographers – who called themselves political arithmeticians – worked hard to improve the methodological tools forged by Graunt. Their research extended mainly in two directions: the life table (for the accurate computation of life insurance annuities) and the indirect estimation of a population (to save a full census). The first life table based on an actual series of deaths by age was computed by Edmund Halley in 1693, but, since he did not have the corresponding data on the population, he used the number of deaths as a proxy for the population exposed to the risk of dying. Slight improvements were added by the Huygens brothers, Leibniz, Kersseboom, Struyck, Smart, Simpson, Deparcieux. It was only in 1766 that the Swede Pehr Wargentin could at last derive a real life table from both census and registration data. Afterwards, thanks to the wonderful work of A. Quetelet in Belgium and W. Farr in England, the accurate way of computing life tables became definitive.

In the 18th century, following Graunt's demonstration that the proportion of births (or deaths or marriages) to the population is roughly constant in a given country and a given period, several political arithmeticians tried to empirically estimate these proportions (called *multipliers*) in order to eventually estimate the population from the annual number of births, deaths or marriages provided by the parish registers, instead of running an exhaustive census, which was much more complicated and costly. Not only demographers (King, Kersseboom, Messance, Moheau, Expilly) but even government authorities (a.o. French ministers Turgot, Necker) made numerous experiments for this purpose. They were prompted by the hope to discover a *universal multiplier* but in fact they observed a variety of context-specific multipliers.

From the end of the 18th century, mathematicians came in to substitute mathematical equations for empirical estimations. It was for the sake of pure science. From the time of Descartes, no new scientific step was complete and definitive unless it had been expressed in a mathematical form. The most important steps were taken by Euler for the algebraic expressions of the dynamics of population growth through time, and by Gompertz and Makeham for the function of mortality by age.

What about fertility? No appropriate measure of fertility was possible until the second half of the 18th century, because the necessary data did not exist yet. The very first tables of births by age of the mother were drafted in Sweden in 1775, and much later (1850) in other countries. Before this, and still long after, political arithmeticians discussed the determinants and differentials of fertility without being able to estimate it. Why did fertility statistics not exist? Because fertility was not a social or political concern. More precisely, the social and political concern about fertility was: *how can we maximize it?* To give adequate and efficient political answers to that question, it was not necessary to measure fertility. Colbert launched an important fertility policy without having any idea of fertility rates. The lack of data obliged scientists to study fertility without refering to age. The adequate measurement of fertility began in Scotland, where an exceptionally detailed series of data on births by age of mother and duration of marriage allowed Matthews Duncan (1866) to define almost all the concepts and tools used nowadays in the analysis of fertility. These were, however, disseminated only in the 20th century.

The first general model of population dynamics was designed in Belgium in 1847 by P.-F. Verhulst, a young scholar working with A. Quetelet. The idea was to provide a mathematical modelisation of the Malthusian theory and Verhulst constructed the so-called logistic function. This model sank into oblivion, and was rediscovered only in 1920 in the USA by Read and Pearl. In the first years of the 20th century, Alfred Lotka designed a general mathematical theory of population dynamics, including the theory of stable populations, which would revive what we now call demographic analysis.

From its very beginning, demography was, simultaneously or alternatively, a question of policy and a question of science.

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DEMOGRAPHY AND STATISTICS

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Each specific science arises and develops in response to the requirements of society and statistics and demography are no exception. Any state always needs to know the size of its population, which is why the population became the first common object of both these branches of know-ledge and indeed of social science at all. Statistics began with the collection and description of population data, demography with the attempts to explain population laws on the basis of these data. Both these branches of knowledge, not yet separated at that time and now closely connected, have played an important role in creating ideas about social systems and population reproduction. New mass data collected during statistical registration require explanation. New ideas and theories in their turn require support by fresh data.

Realization of the content of the science, its tasks and methodology of research changed as it developed. Deepening knowledge in different spheres of reality was leading to a differentiation of sciences and the separation of branches of research into more or less independent fields of investigation. At the same time the accumulation of knowledge was showing the complexity and diversity of contacts and relations between phenomena of the nature and society. The differentiation of sciences in the course of their development led inevitably towards an intensification of their interaction and an integration of results of their own research. Understanding of the subject of each science changed over time, new methods of research developed, the idea of each specific science's position in the whole system of scientific knowledge became more precise. That is why the definition of the content and tasks of demography and statistics, their interrelation and relation to other sciences, should help us understand better the trends of their development and what we could expect in the future.

Population as the object of demography

Each science is a regulated system of knowledge of some cognition object. Each such object possesses different sides and relations, which, being regarded in their natural interrelations, form the essence of this object. This essence may be discovered through some phenomena, accessible to our sensations either directly, or through some kinds of measurement. The goal of scientific knowledge is to discover the essence of these phenomena through investigation, that is to find the laws or main relations on which these phenomena are based. It is these laws or regularities that are the subject of science. While the object of any science is the whole aggregate of phenomena or processes in either field of reality, the subject of cognition of a science is the most important, law-governed relations, determining all phenomena and processes in the considered

field of reality. It is also important what methods a science uses to study and identify the peculiarities of its subject.

What is the object of demography and which law-governed relations and regularities form the subject of this science? Demography is most frequently defined as the population science. A population is undoubtedly an aggregate of people. However this term is often used to mean not an aggregate of *all* people, but to denote certain groups of people, distinguished by characteristics, e.g. sex (male population), age (working age population), or by occupation (agricultural population), etc. Equally, the staff of an enterprise or an audience of spectators are aggregates of people, but it is clear, that a common place of work or theater performance does not unite people into a population.

A population in the common sense is an aggregate of people living in the same territory, that is an aggregate of its inhabitants which is, more precisely, not only living in the territory but participating in some kind of social or economic activities there. However, *inhabitants* may denote all six billion people living on the Earth, several thousand people residing in a town, or e.g. four males wintering on a Polar island. The difference between the inhabitants of the Earth and of a town is only quantitative (ignoring for the present, differences in their ethnic and other social structures), however they differ qualitatively from Polar winterers. The first two groups of inhabitants are human populations that are aggregates of Homo Sapiens specimens, inhabiting in a defined area and more or less isolated from other aggregates of this kind.

The specific characteristic of a human population is its ability to reproduce itself through the continuing occurrence of births and deaths, that is to transform its size and structure by the replacement of generations. The human population presupposes the existence of the two sexes and the ability to crossbreed only within limited age ranges. In order to maintain the ability of self-reproduction the human population should be of sufficiently large size and have a more or less sustainable age-sex structure. In addition, people in it should be connected by some relations governing their behaviour in the field of childbearing and preserving their life. In society, the former are realized mainly in the historically changeable social institutions of marriage and family: the existence of such institutions is an inalienable quality of human populations. The latter are realized by the existence of social norms ordering people and society as a whole to take care of other people and also by a social system of health protection.

All these relations, sometimes called demographic relations, ensure the continuity and maintenance of the self-reproduction of generations, which is always realized and observed in specific aggregates of people. However, in contrast to the notion of population in the everyday sense, as the aggregate of the inhabitants of some area, a population is considered in demography as a human population reproducing itself in the course of generational replacement. The capacity for sustainable self-reproduction and a historically conditioned self-reproduction pattern form the specific quality of the population as a subject of demography, distinguishing it from all other aggregates of people.

This quality is inherent to the human population as a whole and inalienable from its quantitative side: either characteristic of human populations and demographic processes has always been

defined quantitatively and presented in numerical terms. Demography studies the properties not of separate beings, but of human populations as a whole. From this standpoint winterers in Polar island could not be considered as a human population, even if they are an aggregate of inhabitants of an area participating in some economic activities there. Moreover, from this point of view other aggregates of people should not be considered as populations in the everyday sense, though they could serve as an object of research in other sciences. This treatment of the notion of the term *population* was proposed in Russia by Anatoly Vishnevsky and, somewhat later by Leonid Darsky (see Valentey 1969; Ter-Israelyan and Dubnov 1969). It is, of course, a scientific abstraction, but this seems necessary, if we wish to distinguish the object and a subject of population science. Thus, the subject of demography may be defined as the regularities of self-reproduction of human populations of a socially and historically conditioned nature. The study of this field of reality is not covered by the subject of any other science except demography.

Demography and other sciences

Population self-reproduction is governed by some regularities of natural origin. Mortality level, for example, is very high in infancy and childhood, then declines with adolescence and rises with age; the shape of the survivorship curve remains generally the same. The ability to bear children is restricted by age, but the age-specific fertility curve has a strict shape of an iceberg. However, with the emergence of society, humans began to create social relations. Mortality and fertility levels change through time due to changes in social conditions. These processes may be treated as social processes, which have a biological nature. Therefore, the notion of the subject of demography, presented earlier, as regularities of self-reproduction of human populations, places this science on the border between social and natural sciences.

Population reproduction and changes in it are strongly influenced by different relations between people, connected with the social character of their co-existence in society. Therefore demography is closely related to historical sciences, economy, sociology, social psychology, population geography and other sciences.

The relations of demography with the natural sciences, e.g. with anthropology, human ecology, medical genetics and psychology, studying people as the product and object of biological evolution, are strongly influenced by the social determination of demographic processes. However, demography does not study the regularities in those relations which constitute the subjects of these neighbour sciences, but only their influence on population reproduction. Other social sciences, in their turn, use the results of demographic research to understand their own fields of reality better. The features of population reproduction studied by demography are regarded in other social sciences as factors of corresponding processes.

This notion was shared by Russian demography from the very beginning of its existence (see Vishnevsky and Volkov 1986). In the middle of the 20th century it was relatively widespread in European demography (Pavlík et al. 1986; Volkov 1970). At the same time, the broader notion of reproduction of the population is widespread. Population reproduction is regarded as an aggregate of three kinds of movement: social (changes of social structure, social mobility),

natural (fertility and mortality) and spatial (migration). This notion corresponds to the broader definition of population science, like that given by the authors and editors of a well known compendium of demographic works: *"Demography is the study of the size, territorial distribution, and composition of population, changes therein, and the components of such changes, which may be identified as natality, mortality, territorial movement (migration) and social mobility (changes of status)"* (Hauser and Duncan 1959). A similar definition can be found in Donald Bogue's book (1969). The same opinion has been and is shared by several Russian scientists (Urlanis 1976; Ananieva 1997 and others). There are even broader notions of population science, which, however, have not yet been supported by sufficiently advanced research instruments, nor implemented in specific research activity.

It was mentioned that as knowledge about population grew and the complex nature of this object was understood, different aspects of population studies separated and relatively independent branches of science were formed. One example is the formation of population geography as the study of regularities of in the spatial distribution of people (settling) and their resettling by area (migration). Migration or resettling of people obviously changes population sizes (in the everyday notion). It influences the age-sex composition of the population and thereby indirectly fertility and mortality levels, the marriage market, marital and childbearing age. Thus it may be considered as a factor of human population self-reproduction in the above sense. However, this does not yet provide grounds for regarding migration as an inseparable component of this process and for including its regularities in the subject of demography in the narrow sense.

There is a tendency toward the formation of relatively independent branches of science at the frontier fields of demographic studies, studying direct as well indirect socio-demographic interrelations. This is occuring, e.g. at the frontier of demography with economics, history and ethnography. Thus, historical demography is formed with the regularities of population reproduction in historical retrospective as its subject. Ethnic demography is forming at the junction between demography and ethnography, with its subject the reproduction of ethnoses, regularities and factors of changes in their size and composition. There are also grounds for distinguishing economic demography, studying interrelations between economic development and population reproduction, namely economic consequences of changes in reproduction patterns.

Demography and statistics

What is statistics

To clarify the relations between demography and statistics we should define what is meant by statistics. Nowadays the word statistics is used for: 1) a specific field of knowledge, original science; 2) a training discipline, object of teaching; 3) a field of activity in collection, tabulation and analysis (sometimes publication as well) of numerical data (synonym = enumeration) and 4) the data itself. The word was first used by German scientist Gotfrid Achenwall (1749). Since then the meaning of this term and the very notion of statistics as a field of knowledge and as a science has undergone major changes. As far back as 1869, Adolf Quetelet at a Statistical Congress in the Hague counted up to 180 definitions of statistics (Tchuprov 1910) and this collect-

ion could be much enlarged since then. Here, we are interested mainly in the modern notion of the object and contents of statistics as a science.

In the second half of the last century, there were two different understandings of the object of this science. On one hand statistics is regarded as a part of the system of social sciences, as the original material science, studying regularities of formation and changes in numerical relations of social phenomena (Marxist treatment stresses the *indissoluble ties* with qualitative aspects of these relations). On the other hand statistics is regarded as the science of methods of quantitative analysis of the mass phenomena. Statistical method has now become a universal method of cognition. In this sense theory of statistics, or, shortly, statistics, is the consecutive exposition of statistical methods and rules for its application (Yule and Kendall 1950).

It is important to stress that the treatment of statistics as a science is closely interrelated with the treatment of statistics as a field of statistical practice. Enumeration, evidence and tabulation of collected data as the main directions of statistical activities now cover all aspects of social life and are strictly institutionalized. State statistical services cover all branches of the society with statistical information. They do not restrict themselves to data collection and tabulation, but generalize and analyze the information and elaborate methods of such collection and analysis. It is not by chance that in some countries state statistical services are called Statistical Institutes (as in France and Italy), underlining the research nature of such institutions. These interrelations between different aspects of statistical activities make it difficult to distinguish the object and the subject of statistics. Moreover, the limits between statistics as a science and statistical practice are eroded. In many cases this leads toward defining statistics simply as what statisticians do. The collection and analysis of data are also differentiated by the fields of the social sphere, with statistical activity divided into separate parts or *branches*. It is not clear whether these *branches* of statistics can be regarded as original sciences. All these considerations mentioned above concern the problem of the object of statistics. However what is the subject of statistics as the science in this? In other words, can the variety of social facts collected in the course of mass statistical observations be regarded as the subject of material statistical science?

In answer to this question, the prominent Russian theorist of statistics Nikolai Druzhinin explained the tasks of statistical science as follows. Through collection and systematization of facts a statistician tries to find in these facts some regularities which could show the existence of some causal relations. However the empirical statistical regularity discovered through statistical observation shows only the form in which this regularity of mass phenomenon reveals itself. This empirical regularity does not reveal causal relationships lying behind the process being studied, but only an understanding of this relationship only allows us to find the law, which govern the process. However, this is not the matter of statistics, but of the corresponding science (Druzhinin 1964).

Therefore the application of statistical method in scientific investigation is always realized *in collaboration* with science, which uses this method and the data collected for its own goals. Thus, statistics as a material social science does not have its own subject in the sense mentioned. This subject consists of the regularities which the corresponding sciences are interested in. The role of statistics consists of the elaboration of suitable ways and methods of collecting information,

data tabulation and analysis techniques. All these considerations are related to population statistics, which is one of the oldest fields of statistical knowledge, but was formed as an original science and received its modern name later than other areas of social science. It is well known that the term *demography* appeared only in the middle of the 19th century in the title of the book *Eléments de statistique humaine ou Démographie comparée* by the French naturalist and statistician Achille Guillard (1855). The author himself equated demography with population statistics, although he treated the new science very broadly (Landry 1945). It is interesting to note that one year before Guillard wrote in the review of Adolf Quetelet's book on the theory of probabilities, that *"the most successful are those applications of the theory which have as their subject definition of general conditions under which people born, live and die, and which determine the human statistics"* (Guillard 1854, pp. 454–461). The new name of the science was not adopted immediately. Names proposed included *Populationistik* (Chr. Bernoulli), *demology* (Engel and Lexis) and the broader and somewhat indefinite term *population studies* was widespread. Demography was treated for a long time, specifically in Russia, as population statistics and even as a part of population statistics. Polemics around the new science's name reflected the attempts to move beyond the limits of its descriptive nature and to solve the problem of defining the subject of population science forming in the course of differentiation of sciences.

As the result of this process, in the opinion of Russian theorist of statistics Alexander Kaufmann, *"... statistics retains at its exclusive disposal only the narrow sphere which is not contested as the property of any other science: statistics of population and partly moral statistics*" (in those times – study of different asocial phenomena). However he was sure, that *"this situation... undoubtedly is only temporal, transitory"* (Kaufmann 1923). His supposition has now come fully true. Each demographic event is determined by random causes and at the same time by general regularities. In a separate event, the combination of both is a single unique thing. In a large number of events, constituting demographic process, these random causes are mutually destroyed and thus regularities can be revealed. This makes statistical method one of the main methods in demographic research.

Population statistics and demography

The close connection of population studies with population statistics throughout their history makes it impossible to divide these two sciences more or less definitely, even in formal terms. Both branches of knowledge are still developing. Their development has always depended on general conditions of science and research, on ideology and policies and on the prevailing and prestige of either scientific school. Thus, different views on the relation between population statistics and demography survive in contemporary science at the end of the century. Three positions may be divided:

(1) Demography is nothing but population statistics. It studies quantitative regularities of changes in population, while general laws of population developments are the matter of philosophy and political economy. This understanding still prevailed in the former USSR (and in a number of East-European countries as well) not too long ago. The survival of demography as the original social science was denied at all by some statisticians. Official representatives of scientific and administrative institutions recognized the population statistics only as a part of the socio-economic statistics. Theoretical considerations on the regularities of demographic development

were based on obsolete notions which could not explain existing demographic trends. This situation was linked with the monopoly of the state statistical service on all kinds of information, restricted access to population data and ideological dogmatism in the social sciences overall. The relations between demographic statistics and demography were discussed at a scientific conference in Moscow in 1969. The majority of participants adopted the idea that demography may be regarded as an original science which does not boil down to demographic statistics (Ter-Izraeliyan and Dubnov 1969). Nevertheless the old notion still exists.

(2) Both population statistics as a branch of science of statistics, and demography, which studies the regularities of population development, exist at the same time. It should be recalled that the conception of statistics as a comprehensive social science which consists of several parts (or branches) corresponding to different branches of economics (statistics of industry, statistics of agriculture etc.) does not explain the principles of this division and it remains unclear whether each of these parts could be considered as a separate science. In addition, according to contemporary notions, one part of demography is so-called descriptive demography dealing with description of population structures, spatial distribution and vital processes on the basis of statistical data (IUSSP 1982). In this treatment demographic statistics is the same as descriptive demography in a broad sense.

(3) Demography, as defined above, is the science of the regularities of human populations' self-reproduction of the socially and historically conditioned nature. Statistics is a science dealing with methods of studying mass phenomena in the nature and society. Population statistics (demographic statistics) may be regarded as the system of rules for using statistical methods for collection, tabulation and analysis of population reproduction data. The last opinion, shared by the author, belittles neither the significance of statistical methods for demography, nor the importance of activities in the field of collection and analysis of the population data.

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DEMOGRAPHY AND MATHEMATICS

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Introduction

One can say that mathematics and demography are interrelated in that mathematical theories and methods are used for applied research in demography. Moreover, new problems arise from these applications, whose solution then depends upon fundamental mathematical research. These interrelations are a methodological link worthy of research in its own right. This brief outline just touches on the most general characteristics of those aspects of this link that are of particular interest to demographers. The focus here is primarily on the application of mathematics in demography rather than on the feedback in the other direction, as the latter is of more interest to mathematicians.

Mathematics provides fundamental research tools for demography, just as it does for any other contemporary social science. Unlike other sciences, however, demography was born from the application of mathematical expressions. Haley's first life table appeared three and a half centuries ago. Great mathematicians such as Euler and DeMoivre worked on topics that are classified today as demographic. The population laws of Malthus, formulated as progressions, have been known for two centuries, and Gompertz's law of mortality is nearly as old. Some of the early contributions of mathematics to demography were within the field of actuarial science, and they in fact form the origin of demography as a separate science. The initial simplicity later grew into sophisticated demographic theories and models, which today require advanced mathematical knowledge to be understood.

It is necessary to distinguish between the application of mathematical methods in demography and its application in other sciences whose subject of study is any (not necessarily human) population. The latter field is larger. Consider, for example, an excerpt from an abstract of Brillinger (1981). Nearly two decades ago he counted the following mathematical theories as being applicable to population studies: "*…integral equations, non-linear oscillations, differential geometry, dynamical systems, non-linear operations, bifurcation theory, semi-group theory, martingale theory, Markov processes, diffusion processes, branching processes, ergodic theory, prediction theory and state-space models*". Some of these theories have found wide application in demography, while the application of others is limited.

The discussion below will focus on two major points. The first is the dependence of demography on mathematics. The second refers to the nature of the interrelationships between the two. Finally the mutual feedback between the two is briefly mentioned.

The dependence of demography on mathematics

Why is mathematics essential to demography? In general, mathematics contributes to the attainment of *theoretical rigour* as the basis of any scientific findings. Theoretical rigour does not turn demography into a deductive science. The latter represents a set of theoretical blocks, empirical generalisations, and tools of measurement. Mathematics is applied in all these three areas. The mechanisms by which mathematical models help gain demographic knowledge are similar to those employed in other sciences. For the study of a causal relationship of interest it is necessary to disregard links of secondary importance, thereby assuming a level of abstraction from reality. The links of primary importance are then modelled and studied. The established relationship is translated into the *language* of reality. The rationality of the approach makes it possible to avoid irrational methods such as intuition and belief. In addition, it allows for a careful study of the underlying assumptions and the argumentation behind them.

Demography, in particular, gains through the implementation of such mechanisms in the improvement of measurement, in the replacement of intuition with theoretical formulations, and in the enlargement of knowledge acquired by relaxing the assumptions of the theoretical and model formulations.

(1) *Improvement of measurement*. Demographers measure demographic events and population stocks on the basis of data. Thus, they usually face two types of problems: that of having too many data and that of having too few. In the first case demographers use descriptive methods to summarise the large data sets into a small number of measurement indicators. The indicators should successfully represent the information hidden in the data, but they are often too crude and inaccurate. In such cases mathematical models become necessary. A simple example is the comparison of an indicator of mortality such as the crude death rate with the life expectancy estimated by using a life table method.

Cases where the data sets are too small are more common. Then mathematical theories can be used to describe basic principles that underlie demographic events and stocks. The assumptions and rules of building these theories substitute for the lack or insufficiency of data. A well-known example is the theory of stable populations and its numerous applications in demography. No real population is stable, but the assumption of stability introduces errors that are considerably smaller than the gain it yields.

Measurement indicators are required to ensure comparability in their application to the study of different populations. For this purpose demographers use specific methods. For example, standardisation is used to remove the effect of the age structure on the comparison of age-specific mortality. Mathematics contributes to the improvement of measurement. A good illustration is provided by a recent formula proposed by Bongaarts and Feeney (1998) which estimates a period total fertility rate (TFR) free of tempo effects.

(2) *Replacement of intuition*. A basic requirement of the scientific method is that when scientists repeat the steps of reported research, they should arrive at the same results. Thus, irrational methods of exploration will not contribute to a finding that can be classified as scientific. The

general way to avoid irrationality is by applying rigorous theories soundly described by relevant axioms and inference rules. Mathematics provides such theories.

Intuition is an irrational method that is particularly often used in practice. Intuition may even be required in cases where scientific findings are inconclusive. Consider, for example, the abrupt fall in fertility in the countries of Central or Eastern Europe during the 1990s. It is measured by a TFR with the lowest ever-recorded levels of around 1.1. The fertility decline is accompanied by a rise in the mean ages of childbearing, which indicates a postponement of births. Demographers know that during times of postponement the period TFR reports levels of fertility that are lower than actual fertility. To what extent is low fertility a problem of measurement, and to what extent is it a reflection of changes in behaviour? A rigorous answer would rely on completed fertility, which will not become available until decades later, but society and politicians need the answer now. Given no other information, a demographer is left to rely on his intuition. The dominant opinion of a demographic *crisis* or even *catastrophe* that some demographers share concerning the case at hand shows that they consider the postponement effect to be very small.

A study by Philipov and Kohler (1999) based on the Bongaarts and Feeney formula shows, however, that the adjusted levels are as high as 1.7 or even higher. This is not a *crisis* level. The formula was inferred using mathematical methods and is valid under certain assumptions. One can dispute assumptions but not intuition. The latter is intractable.

Another example of the benefit of replacing intuition with assumptions is controlling for unobserved heterogeneity. Scientists know about the existence and impact of heterogeneity and can use their intuition to measure its effect. Mathematical theories have been constructed that do a better job. They provide methods of controlling for unobserved heterogeneity. Since these methods are based on assumptions it becomes easier to trace the way the control on unobserved heterogeneity is carried out, by tracing the relevant assumptions.

(3) *Relaxation of assumptions.* The expansion of knowledge is a continuous process. New theories, models, and indicators are developed and older ones improved. Usually a rigorous theory (or model, or indicator) enlarges its scope of implementation by relaxing some of the assumptions that it builds upon. The examples below illustrate some fields of recent interest to demographers.

The *variable-r* method, which is an extension of the conventional stable population theory where the rate of growth r is assumed constant. As the name suggests, the latter can vary in the *variable-r* method. The method was first discussed by Preston and Coale (1982) and then refined by Arthur and Vaupel (1984). With this, the scope of implementation of the stable population theory was enlarged.

A further example involves the mathematics of two-sex populations. Conventional marital-status life tables and population projections are based on the assumption of a one-sex population. Adapting such models for two-sex populations may introduce considerable divergence from the single-sex results (cf., e.g. the writings of Pollard).

Population forecasts are among the most widely implemented products of demography, although they usually turn out to be inaccurate. The need to refine them brought about increased research in the field, especially in the last decade. Path-breaking steps have been taken towards the development of new mathematical and statistical methods. It is curious to note that the more sophisticated methods imply higher uncertainty in forecasting as a response to the search for higher accuracy. It will not be surprising if demography arrives at a new conception of population forecasts, in which uncertainty will be of primary importance (Lutz, Vaupel and Ahlburg 1998).

Content of the application of mathematics in demography

The content of mathematical applications in demography comprises diverse topics of primary importance to demographers. This large area will be illustrated – quite appropriately for the Round Table discussion at the Charles University – by referring to contemporary advanced university courses in demography. The intention here is not to discuss their full content but to exemplify the presence of mathematics in demography. Independently of whether there are one or more such courses, the following two areas of knowledge cannot be missed. Their names could be different, but that is irrelevant to the discussion.

(1) *Formal demography*. This area will include classical fundamental demographic issues. Consider, for example, population growth. Relevant to this are the analysis of the Leslie matrix and population waves, the ergodic properties of a population projection (recall Keyfitz: *a population forgets its past*) and stable population theory. These topics have their recent achievements, which quickly turned into modern classics. An example in stable population theory is the generalisation known as the *variable-r* method, which was mentioned above. Other significant extensions refer to probabilistic/stochastic population forecasts and micro-macro simulations (Lutz, Vaupel and Ahlburg 1998). Consider as another example life tables, which are perhaps the best known demographic model outside demography. There have been recent developments here involving the incorporation of multi-dimensionality and statistical inference. This issue intersects with event history analysis. In addition, model life tables, model fertility and migration schedules are examples of using mathematics for the construction of empirical demographic models.

Both areas, population growth and life tables, have been extended so as to include two-sex populations. This introduces non-linearity to the models. Non-linearity is a field of mathematics that is being implemented to an increasing extent in demography. One of its implications is that human behaviour may be non-predictable. Then demographic trends could be non-predictable, especially regarding fertility, marriage/cohabitation, and other areas where short-term trends depend on behaviour. Under certain conditions a population forecast may include the non-predictability of some population groups, for example, the youngest. Non-linear mathematics may eventually force demographers to accept unpredictability.

(2) *Statistical demography*. This area will include applications of intensity regression analysis, better known to demographers by specific names, such as event-history, survival, or hazard analysis. Special emphasis will be placed on demographic topics like competing risk (example:

multiple-decrement life tables) and controlling for unobserved heterogeneity, among others things. Concerning the latter see, for example, Vaupel and Yashin (1985), where one of the findings is that *individuals age quicker than populations*.

The statistical topics will be dealt with in the light of their application in demography, e.g., parametric and non-parametric intensity-regression models; models for counts of data; etc. These two broad areas differ with respect both to the purpose and employment of mathematical methods. They will intersect, though, when demographic topics are considered. For example, life tables cannot be missed in formal demography, but they are present in intensity regression analysis by its very nature. Hoem (1993) brought the latter issue to the attention of demographers, showing that multistate life tables are an application of event-history analysis. In this article he also showed the same for indirect standardisation. There is an important difference between the two areas outlined above. Formal demography includes classical demographic topics that have been dealt with for many decades, along with recent achievements and generalisations. Statistical demography focuses primarily on recent research which has appeared in the last decade or two, and is rapidly increasing at present. In addition, most of the contemporary demographic research is based on the application of methods from statistical demography. This difference reflects the present status of the interrelations between mathematics and demography. Mathematical statistics is the most widely applied mathematical discipline in demography today. Why this preference for mathematical statistics?

A permanent headache for demographers is the problem of data availability. Vital statistical data are very expensive and are insufficient for contemporary analyses, due to their narrow scope. This has led to a focussing of attention on micro-level data, obtained through specialised surveys. The application of statistical methods that provide detailed procedures for parameter estimation, hypothesis testing, and model evaluation eases the testing of theories and allows for the use of large data sets. In addition, the development of computers and software made the implementation of mathematical statistics as easy as pressing of a key on a computer keyboard – once the data are prepared and the key properly selected. Technically, the implementation of a model today may take just a day or two, if not hours, rather than the months of work that were necessary some years ago. The ease of applying statistical models translates as convenience in the checking of theories, the construction of models, and in measurement, to the benefit of contemporary demographic knowledge.

The use of survey data raises new types of problems related to data accuracy. Survey data are far from being perfect, even in the most developed countries. Recall, for example, problems such as a high level of non-response or a small number of observations. Survey data are imperfect in other respects as compared to vital statistics. Therefore the available methods for the improvement of demographic data may need additional elaboration in order to be made applicable to survey data. As an example, consider the improvement of conventional data by using model age schedules. Similar tools can be developed where survey data are considered. The available methods can also be made appropriate, as has been shown for example by Hakkert (1981) for the study of relational life tables, Henz and Huinink (1999) for the usage of the Coale-McNeal model, and Rodriguez and Philipov (1997) for the Coale-Trussell model. There will be more to be said on this topic in the coming years.

The preference given to mathematical statistics does not mean the displacement of other mathematical methods used in formal demography. It is often the result of upgrading existing analytical tools. Consider the development of multiregional demography, known also as multidimensional, or multistate, demography. It was first developed as a set of deterministic models that are an extension of conventional demographic models via an increase in the number of dimensions (Rogers 1975). The increment-decrement life table, for example, describes transitions from one status to another with the help of life-table functions. Such a life-table could be represented as a Markov model. Hoem and Funck-Jensen (1982) developed the corresponding statistical methodology. Today multistate life tables can be implemented either as a tool in deterministic multistate models, or as an application in event-history analysis.

Feedback between mathematics and demography

The application of mathematics in demography raises new problems that need fundamental mathematical research. This is how demography can contribute to the development of mathematics. Although demography has never brought about the existence of a specific mathematical discipline or even a branch of a discipline, this question of feedback is very real. Demography has made important contributions to the development of certain applied mathematical disciplines, such as actuarial mathematics and population mathematics. Life table mathematics is an important branch of these and other areas of applied mathematics. Indeed, Alfred Lotka, who is regarded as the father of mathematical demography, was an actuarial scientist. Demography contributes to mathematics particularly by putting forward problems that must be solved by professionals in mathematical statistics and its branches. This is especially relevant concerning the application of intensity-regression analysis and controlling for unobserved heterogeneity.

Conclusion

This brief outline has shown that mathematics has acquired a permanent place in demography. Fundamental demographic research is by and large of a mathematical nature. Mathematics is needed to enlarge theories, relax assumptions, and to construct new or improved tools of measurement. Mathematical methods are a necessary (but not sufficient) part of the applied work that searches for causal relations between demographic and explanatory variables.

Mathematics is often present in demography in the form of sophisticated theories and models that require specific mathematical knowledge if they are to be understood and applied by the demographer. Demographers also apply methods of other sciences, such as sociology, economics, geography, genetics, etc. It is impossible for a demographer to apply this vast knowledge while working alone. That is why demographers communicate with specialists from other sciences, including mathematicians. Teams of this kind are much more productive through the principle of increased returns. Scientists skilled in the use of mathematical tools are the most frequent members of such teams – apart from demographers.

The high level of sophistication of mathematical applications in demography requires a particular specialisation on the part of researchers in specific areas of mathematics and demography. For example, some mathematicians work predominantly on the study of longevity, multistate demography, or population forecasts; some demographers may devote a lot of their time to the implementation of intensity regression analyses or to controlling for unobserved heterogeneity. The interaction between mathematics and demography is bound to grow in importance in the future. Hence one can expect a further specialisation of professionals into the joint sub-areas of mathematics and demography.

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TWINNING DEMOGRAPHY AND THE SOCIAL SCIENCES

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Now that we are gathered here to commemorate the occasion of 100 years of teaching demography at Charles University of Prague, it is my pleasure to congratulate you – all the people behind this magnificent institute: director and former director, senior and junior researchers.

Together you have turned this institute for demographic teaching and research into a prestigious, and well-known one. On behalf of the Board, and my colleagues at the Netherlands Interdisciplinary Demographic Institute (NIDI) in The Hague, I would like to extend my heartiest congratulations, and best wishes for the next 100 years!

Educated as a sociologist, more specifically as a social science survey research methodologist, I gradually evolved into a demographer, focussing on the description, and explanation of demographic trends and developments. I investigated different trends, ranging from the transition of home-leaving by young adults, the changes in the social position of never married older adults (central theme of my Ph.D. thesis 1969) to transitions between living arrangements among elderly people. I analysed their determinants, based on cross-sectional, longitudinal and panel surveys, and their policy implications.

In doing so, I became more and more enthusiastic about what both disciplines can offer one another. The possibility of a fruitful cooperation in the broad field of population studies deserves more attention. A few examples:

- In the field of ageing and the aged. Ageing includes much more than an interesting change in the population pyramid.
- In the field of family and household structures and family support networks as available in old and modern types of family. This field includes much more than can be investigated by simply comparing the size of the population category aged 65 and over, to the size of the category of people aged 20 to 65 years.
- In the field of gender studies. The socio-economic position of several subpopulations of society deserves more research attention, e.g. as far as the distribution of poverty is concerned, with special attention for the position of women heading one-parent families and older widows living alone in a one-person household.

After what has been said until now, it will not come as a surprise that I fully agree with the ideas put forward by Caldwell in his famous article *Demography and Social Sciences* (1996) and formulated very concisely as follows: *"demographers are in their element when there are massive but limited data which must be used skilfully to throw light on a matter which really needs much*

more information to explain it fully" (Caldwell 1996, p. 319), and *"demographers are convinced that raw data, and especially comparisons of raw data, can be misleading unless they are treated with techiques that will remove the distortions"* (op. cit., p. 328).

He also states that this is where social scientists working in the field of demography/population studies step in. In my opinion they step in with data sets, based on a carefully developed research design, with a well designed questionnaire, including a relatively large set of theoretical concepts that have been clearly conceptualized and operationalized, oriented towards interviewing a sample of respondents chosen at random from the registers of an optimal selection of municipalities, yielding a data set that is truly representative of the population being studied.

So, social scientists can fill the gap in knowledge found among demographers who have to rely solely on the aggregated official data sets provided by National Statistics and based on censuses or large scale registration systems. In general, empirical social scientists provide more detailed information, including e.g. the answers to more and more specific questions about successive steps in a respondent's life history, the motives and rationale of the respondent, the ideas, norms and values of important persons in his or her social environment and the persons behind decisions and transitions.

As Caldwell so clearly explained, cooperation between demography and sociology is often driven by the wish expressed by both disciplines to improve existing research methodology.

The breakthrough in research methodology is directly related to research activities conducted during World War II. These include the development of multi-item measurement techniques (scales), the methods used in survey research, the further refinement of techniques to analyse the interconnectness of large sets of variables via multivariate techniques and so on. Psychology and sociology have both taken advantage of these methodological innovations by accepting them at an early stage. Certain circles within demography were among the next wave of scholars who adopted these new techniques.

We have to bear in mind, however, that these ideas are not subscribed to all over Europe. In fact, there is a sharp discrepancy between the ideas underlined by the demographers who contribute for example to Population Studies, and a number of demographers in continental Europe.

In this context, I will present some statements by Roland Pressat, taken from his publication (1996, p. 241): *"...quel sera le démographe de l'avenir? Un historien, un psychologue,...? J'espère que non. J'aimerais que ce soit un spécialiste, pour qui toute la richesse en connaissances et en méthodologie que la démographie a créée durant plus d'un siècle d'existence, continuerait à faire partie de son enseignement de base, et lui servirait à explorer l'histoire, la sociologie, etc..., pour mieux comprendre le problème principal de la démographie, l'évolution de la reproduction de la population"*.

He also states: *"Si, ... pour la meilleure compréhension des phénomènes, la démographie pourra s'imposer dans les nombreuses études situées hors du champ du démographe, mais où sont en jeu des collectivités humaines"* (op. cit., p. 242).

Further on, he writes: "*Un volet important de la recherche s'intéresse aux motivations, aux comportements, aux désirs en matière de descendance et c'est là que l'alliance entre la démographie, la sociologie, l'anthropologie, voire l'économie est particulièrement forte*" (op. cit., p. 244).

So, Pressat states that it is only in the case of research into the motives and wishes behind demographic decisions as well as research oriented towards the details of demographic behaviour that cooperation between demography on the one hand and sociology, anthropology, and economics on the other has an added value.

Demographers are not likely to study religious matters such as the percentage of baptism among newly borns, nor are they particularly interested in the percentages of newly weds who organize a wedding party or a honeymoon trip in relation to their socio-cultural background. Sociologists, on the other hand, will normally refrain from global or historical statistical comparisons of wedding traditions (Verret 1995). And that is how it should be, now and in the future. However I am convinced that by joining forces these two disciplines can reach a higher level of understanding of the phenomena studied.

Let me give you an example. When studying fertility trends or nuptiality trends, scientists who also take account of factors such as the homogeneity or heterogeneity of educational levels of both partners, such as the homogeneity or heterogeneity of fertility intentions versus occupational aspirations of both partners, factors such as the norms and values of specific groups of forerunners and trendsetters in society, factors such as the norms and values of significant other peers(!) and parents, can enrich the description and deepen our understanding of new phenomena and developments. The benefits of a multidisciplinary approach were recognised long ago.

In my opinion, the latest round of the Family and Fertility Surveys can be presented as an interesting example of the good cooperation between demographers and other social scientists. Recently, in my country, the Netherlands, a promising initiative has been undertaken by demographers, sociologists, social psychologists and people from ethnic studies, in having prepared a large scale research programme entitled: Family relationships: the ties that bind! This programme goes in combination with the proposal of the Netherlands Kinship Panel study. Union formation and dissolution, and (support) relationships inside the nuclear family as well as with family members outside the household, will be among the central themes in this research programme.

Summarizing:
On the one hand, I am in favour of a multidisciplinary approach to investigating population themes, if possible and if fruitful. But on the other hand, I am convinced that such a fruitful cooperation will only be possible if both demography and sociology/social sciences maintain the specific and unique characteristics of their own disciplines.

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DEMOGRAPHY AND SOCIOLOGY

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My remarks concerning the relationship between Demography and Sociology begin with a rather personal introduction, answering the question, of how it came to be that a sociologist became an at least partly accepted member of the *demographic club*? After that follows an attempt to interpret the relationship between demography and sociology asking whether the concepts of *migration* and/or *family relationships* might be useful in answering in this respect (§ 2). Before a conclusion (§ 4) is presented, the results of a quantitative content analysis of articles that appeared in four demographic journals between 1997 and 1999 will be described and commented upon. This content analysis has been carried out in order to give an also empirically based answer to the question regarding the relationship between sociology and demography (§ 3).

A personal introduction

My membership of the DDC (Distinguished Demographic Club) is not the result of a decision on my part to apply for it but solely the consequence of a contingent event.

A long time ago at the beginning of my academic career, it was not a sociologist but a demographer (Hermann Schubnell) who first took note of my doctoral thesis *Migration: A sociological contribution to its explanation* (1970) and invited me to a population congress to read a paper on theoretical sociological approaches to migration. Schubnell introduced me to the audience by saying that, when he had read my book, it had puzzled him to see, that somebody could write about migration, one of *the* domains of demography, without even mentioning this; indeed, he had not even found the word demography in my text. And, he continued, he had invited me to the congress in order to present a man who, on the one hand, had been so bold as to completely ignore the many and valuable demographic contributions to the study of migration, but who, on the other hand, had impressed him with his remarkable, theoretical approach to its explanation. In fact, I had not been bold, but in part simply ignorant regarding demography and partly naive.

I finally realized that I was somewhere in a no-man's-land. Not many sociologists had considered migration as a truly sociological domain, while for demographers it was definitely one of their three central variables (fertility, mortality and migration), but they had done little to develop proper *theories* of migration.

This state of affairs offered, of course, an excellent opportunity to create a theory of migration of my own. I have to confess, however, that in the beginning my main interest was not so much in migration as such, or migration theory, but sociological theory in general. But, because I have always been convinced that general theories have to prove their strength and fruitfulness in their

application to reality, it was more by chance that I tried to apply the theory I had developed to the phenomenon of migration; maybe because my parents had migrated (from Poland) and I had become a migrant myself: first a second-generation migrant (in Germany) and later on a first-generation migrant in Switzerland.

Today, migration is no longer a marginal field of sociological research; on the contrary, it has become a field of utmost importance and migration experts and migration research is enjoyng a boom, the end of which is not foreseeable. So it is true to say that migration research itself has migrated from the periphery of sociology to its centre, which is also a characteristic of today's migration streams.

Commuters or the family of social sciences

Both demography and sociology deal, for example, with *primary social systems* (like partnerships, marriages and families) and with *social processes* (such as migration) to mention only two phenomena to which I have devoted most of my theorising and empirical research. I have done this as a sociologist who has also developed an interest in demographic questions and demographic research.

Can the relationship between sociology and demography be interpreted in terms of the social phenomena of family or migration? That is the question which I shall now try to answer.

At first glance, it seems quite clear that demography, as well as sociology, are members of the same scientific family: the family of the so-called social sciences. The term *family* implies, of course, the question of who is the father, who is the mother and who are the children? In order to avoid problems of ranking, one could say that all of us are the social sciences' children.

But there are also demographers who have not been trained as social scientists but as geographers, mathematicians, biologists or medical doctors. For some of these, sociology is still regarded as a somewhat dubious enterprise, lacking, for instance, the precision which mathematical demographic models claim to possess, and lacking the well-established laws existing in the natural sciences, which are sometimes just named *sciences.*

On the other hand, there are (also only a few) sociologists who consider demography not to be a real science but rather a kind of bookkeeping – population bookkeeping. In their view, it keeps records or notes of what comes in (via fertility and immigration) and what goes out (via mortality and emigration), i.e. demography notes gains and losses like any bookkeeper does. Its population projections would thus have the same status as the financial budgets which the bookkeeper sets up for the years t_1–t_n. In other words: in the view of some sociologists, demography is not only not a social science but no science at all, because it does not have explanatory theories. Could one say that this is already suggested by its name: demography (from Greek: demos – people, gráphein – to write, to describe)? Why did Achille Guillard, who coined the term in 1855, not call the analysis of population processes *Demology* or *Demonomy* (in analogy to

Sociology or *Economy*) which would have indicated that it deals with *theories* (logoi) or *laws* (nomoi)?

In any case, demography lacks what in sociology is called *grand theories*; theories like, for instance, Talcott Parsons' structural functionalist theory or Niklas Luhmann's social system theory. And could it be that, because of this, demographic empirical/descriptive research lacks the guidance of theories, as suggested by the following definition of *demographic analysis*: *"A form of statistical analysis which employs, for the most part, a modest array of mathemathical and statistical techniques to deal with the data produced by censuses, surveys and vital registration systems"* (Pressat 1985, p. 52).

And to go even further, could one maintain that demography ultimately cannot really explain population processes, nor predict such processes, beyond solely empirically based extrapolations? If the answer were: *Yes, this is so*, one could conclude that a close – and, as I see it, fruitful – interaction and cooperation between sociology and demography is called for, to make the best of the virtues of both disciplines. And an open-minded sociologist cannot overlook the fact that demography, without the slightest doubt, has many virtues. I shall not, however, mention the virtues of sociology further, since it is not good form to talk about one's own virtues.

So: What then are demographic virtues in contrast to sociological weaknesses?

- Demography reports hard facts, harder than most sociological data;
- demography reports factual behaviour not opinions, attitudes, plans etc. as sociology often does;
- demography's central variables (fertility, mortality, migration) are well defined, which is much less the case in sociology;
- in demographic censuses people are more or less *forced* to reply, while sociological samples often suffer from high rates of non-respondents. As an early example of a census, I quote from Luke II, 2.1: *"At that time a decree was issued by Augustus Caesar to conduct a census of the whole Empire. Everyone went to be registered, each to his own town."*; this census was first carried out when Quirinius was legate of Syria;
- there are well-established organizations (statistical offices) which have been collecting data for a long time, and the collection of demographic data as such dates back into human history even over thousands of years while reliable sociological data cover not much more than the past fifty years;
- demography can precisely model population developments; something sociology cannot do with societal or social developments, at least not to the same extent.

Finally, it seems that *migration* could be the solution to the questions raised. But which type of migration? *Permanent migration, seasonal migration, temporary migration or commuting?* I would suggest *commuting*, which means that you remain in the place where you usually live, but spend some time working elsewhere. And that is what sociologists as well as demographers should do. The outcome of such a migration will not be a *clash of (scientific) civilizations* but a kind of *melting pot*, a melting pot which might be called *sociology of population or social demography*, defined as follows: "*The branch of demography* (or sociology, H.-N.) *dealing with*

the interaction of population and the wider life of societies" (Pressat 1985, p. 209). Commuting between sociology and demography would be one of the (rare) cases where migration would not cause more problems than it solves.

Some results of a content analysis

As I said at the beginning, I wanted to empirically test the hypothesis that there is a close relationship between sociology and demography. For this reason I carried out a content analysis of different demographic journals[1] asking whether that hypothesis could be confirmed and to what extent.

As can be seen from Figure 1, the greatest number authors of articles in demographic journals work in institutions which can clearly be described as demographic. Although some of the authors might have a training in sociology, the fact remains that sociological *institutes* (which form only a small proportion of *economic and social science institutes*) seem not to be an important source of demographic research. Nevertheless it can validly be said that one half of the authors came from non-demographic institutes.

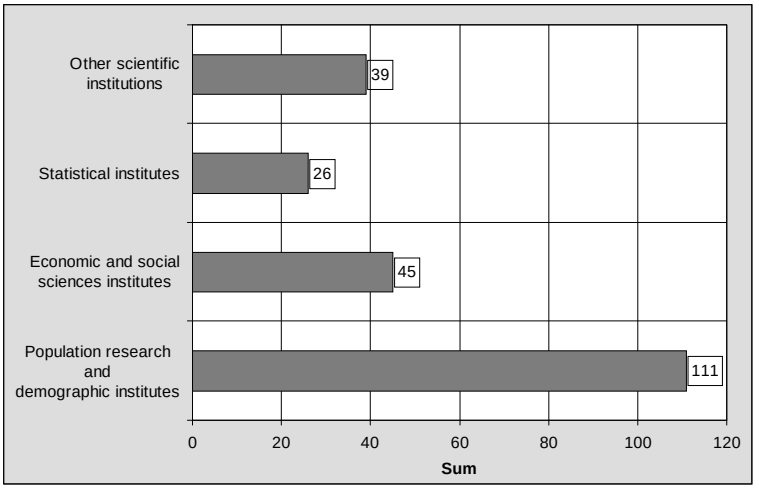

Figure 1: Frequencies of institutional affiliations of authors of articles (absolute values)

A look at Figure 2 reveals that the *(Meta-)discourse of methods* is the most important. Demographic journals obviously reserve a lot of space for the discussion of old and new methods, pragmatic difficulties in empirical research in general and in particular quality of sources, and

[1]The demographic journals are: *GENUS / Population / European Journal of Population / Population Studies. A Journal of Demography.* Volumes analysed: 1997–1998 and early 1999.

so on. A very large number of articles, however, deal with topics which relate to *way of life and lifestyle*. Although roughly one half of the articles deal with demographic subjects like migration or fertility (combined with more sociological topics), there remains the fact that *lifestyle* appears to be the most important link between demographic and sociological topics. As we can see from Figure 3, demographic journals publish more mathematical and descriptive articles than analytical reflexive ones. This fact should be seen in relation to an other result of our survey: in demographic articles grand theories and analytical reflections are not very widespread.

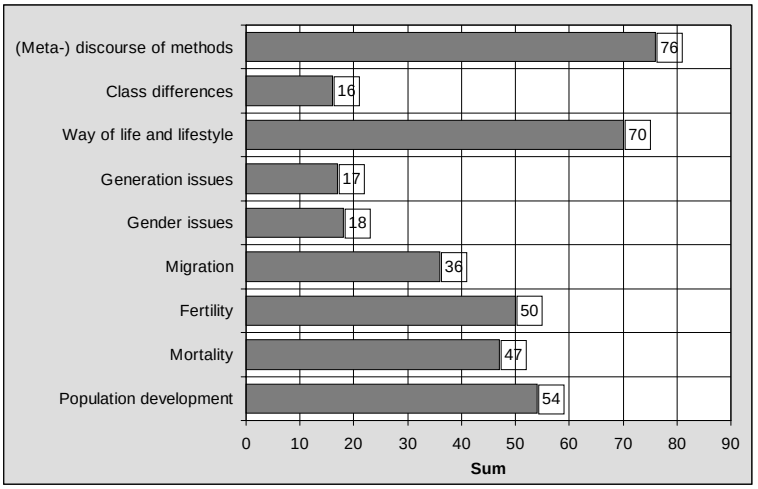

Figure 2: Frequencies of research subjects (absolute values)

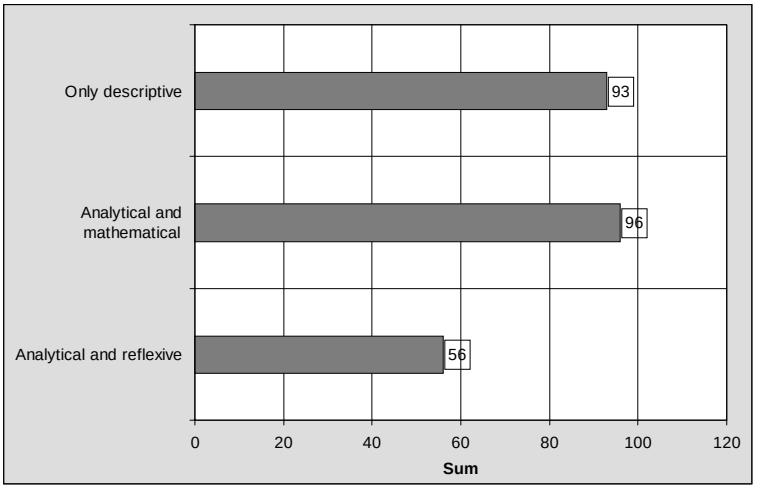

Figure 3: Frequencies of the type of article (absolute values)

Looking only at demographic variables, Figure 4 proves that *age* is very important for demographers. It may seem surprising that *migration* – one of the three fundamental variables of demography – does not appear in this graph. It is, however, the fact that certain *consequences* of *migration* are dealt with, e.g. intermarriages or differential fertility, but that migration as a factor (a variable) contributing to the size of population was treated only marginally, which is not the case with regard to fertility and mortality.

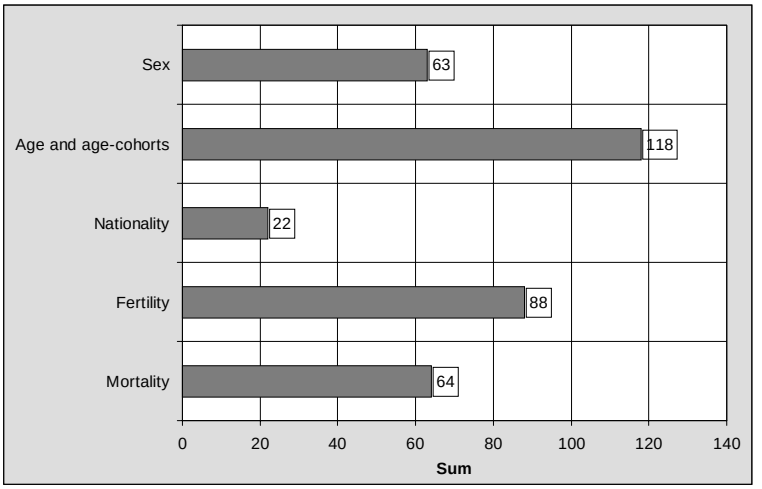

Figure 4: Frequencies of demographic variables (absolute values)

A look at Figure 5 demonstrates clearly that sociological variables are by no means neglected in the articles analysed. *Communities and institutions* on the one side and *status position* on the other are obviously seen as determining population processes. Further the category *other sociological variables* includes a very large number of particular variables like *moral aspects, minorities, deviant behaviour, gender discrimination* and so on. In fact, there are more than a dozen variables subsumed in this category, each of these appearing only a few times.

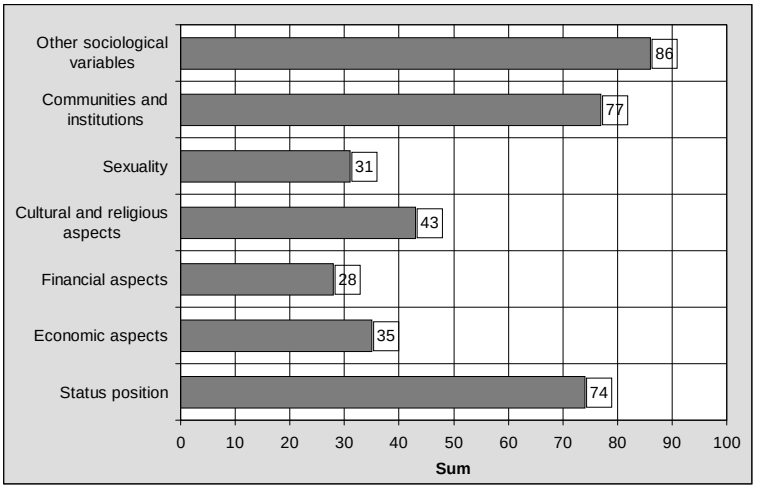

Figure 5: Frequencies of sociological variables (absolute figures)

Conclusion

To conclude, I have suggested that demography and sociology can be regarded as members of one family or respectively that their representatives are commuters between these two disciplines. The results of my content analysis seem to confirm both hypotheses: Demography and Sociology are commuting members of *one* family.

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BRIDGING DEMOGRAPHY AND SOCIAL PSYCHOLOGY

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There is a very old joke that goes like this:
I was walking down the street late last night and saw a very drunk man on his hands and knees under the street light.
I asked, 'Are you OK?'
He said 'Yes, I am looking for my car keys.'
Did you lose them near here?
'No, I lost them somewhere over there, in the bushes.'
Well, why are you looking for them under the street light?
'Because it is dark in the bushes, stupid. I can see here!'

Sometimes we researchers are in a similar situation. We are looking for some social phenomena and realise, they are *out there somewhere*, but we have to look in places where we can see them clearly. The world today is becoming more complex and integrated. Researchers elaborate new and more sophisticated methods of measurement and apply new technologies for analysis. The demographers explain and can give fairly exact prognoses of the trends of demographic behaviour. What does determine demographic behaviour? There are many theories trying to explain it.

- A common explanation is connected with *the demographic transitions* – in human history there have been several stages of demographic behaviour, and mankind has experienced several demographic transitions in its history. Very briefly, during a transition at first mortality decreases and after that the population starts to grow rapidly. Then the birth rate decreases, too and the processes are in balance again. The decrease of mortality can be explained by the development of medical services. But why after the decrease of the death rate does the birth rate decrease?
- Further, the regularities of social security have been used to explain the number of children. Historically, the only support for people in their old age was their own children, but nowadays in developed countries the functions of care taking have been handed over to society as a whole, so the kinship network has lost this historic meaning.
- The influence of economic factors on demographic processes is quite contradictory. On one hand, it is well known that in general, the lower classes and groups of the population with a lower income have more children than the higher classes and those groups with a higher income. This is true for all countries. The poorer the country is, the higher, in general, is the birth rate. The lowest birth rate is in the European countries that are, in general, among the richest in the world. But at the same time it is also well known that economic crises have caused declines in birth rates.

If we follow the changes of demographic behaviour of the Estonian population through its history, it is not very easy to explain them using economic or demographic theories.

Professor Ene-Margit Tiit in her overview of population development in Estonia (1999) states that twice in history, in the 16th and the 18th centuries, the population of Estonia decreased (due to wars, plagues and famines) almost to its critical size, but recovered very rapidly. In the 19th century the growth of the population slowed down. After the First World War, in independent Estonia the birth rate was very low. While in most European countries there was a so-called *baby-boom* in the 1920s, in Estonia the natural increase was almost zero for twenty years (1920–1940). During the Second World War and the German occupation, the birth rate did not drop essentially, and after the war the rise in the birth rate was rather small. About 15–20 years after the end of the war the birth rate started to grow (and at the same time the age at first marriage and age at giving birth dropped).

The total fertility rate in 1988 and 1989, during the so-called *Singing Revolution*, was unexpectedly high in Estonia if compared to the European average – 2.26 and 2.21 respectively (Figure 1). After that peak, a dramatic decrease in the birth rate started; it lasted almost 10 years reaching its bottom in 1994 when the natural population increase was -5.2. This decrease in fertility was the biggest in the history of the Estonian nation. By 1998, the total fertility rate had dropped to 1.21, a level that was one of the lowest in Europe. It means that if this level of fertility continued, it would reproduce only about 60% of the population.

Today, the low fertility rate and negative natural population increase are taken as a serious danger for the survival of the Estonians. Survival as a nation is the main concern expressed by demographers and pointed out as a social problem by policy-makers.

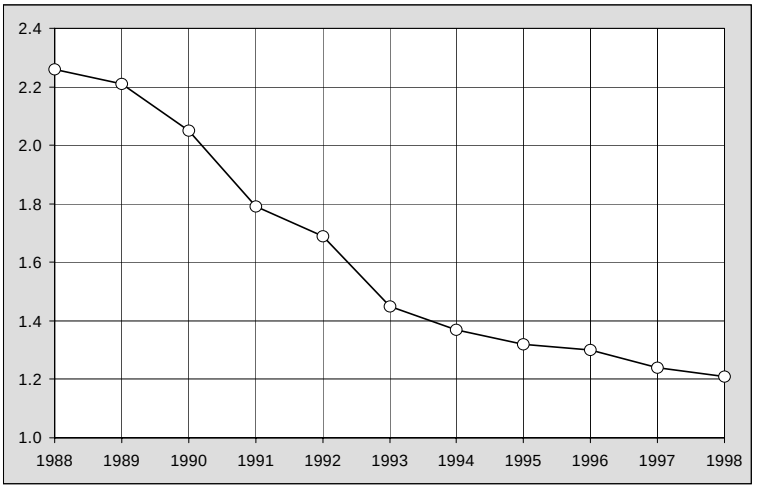

Figure 1: Total fertility rate, 1988–1998
Source: Statistical Office of Estonia

One of the main factors impacting on fertility is the increasing age of a mother giving birth to her first child (Tiit 1999). As a rule, the increase in the mother's age at first birth is correlated with a lower number of births per woman. Another impacting factor is the still high abortion rate, i.e., there is the problem of so-called *unborn children*. Although the number of abortions has dropped by half during the last ten years, the share of abortions to live births has not changed notably.

An even more drastic reason for low fertility was revealed in a students' survey of reproductive attitudes in 1990 and 1996 (Kutsar & Tiit 2000). In 1990, there were 12.8% of the Estonian-speaking male students-to-be who regarded zero as the most reasonable number of children in the family. By 1996, there was an increasing number of female students who agreed with the latter ones.

The main reason for not wishing for more children pointed out by the respondents of the social survey *Living Conditions in Estonia (1999)* was the economic situation of families. The high abortion rate and bad economic situation of households with children have aroused much public attention. The low number of desired children in the family is in the focus of the Ministry of Regional and Population Issues of Estonia. An Advisory Board at the ministry is attempting to implement new regulations to encourage motherhood.

It is surprising, that if we compare two ethnic groups of population, then since 1960s ethnic Estonians have had a higher birth rate than Russians living in Estonia (in spite of the fact that in their homeland they had, as a rule, a higher birth rate) (Tiit 1999). Also the decrease of birth rate has been more drastic in the case of non-Estonians living in Estonia than for Estonians (Figure 2).

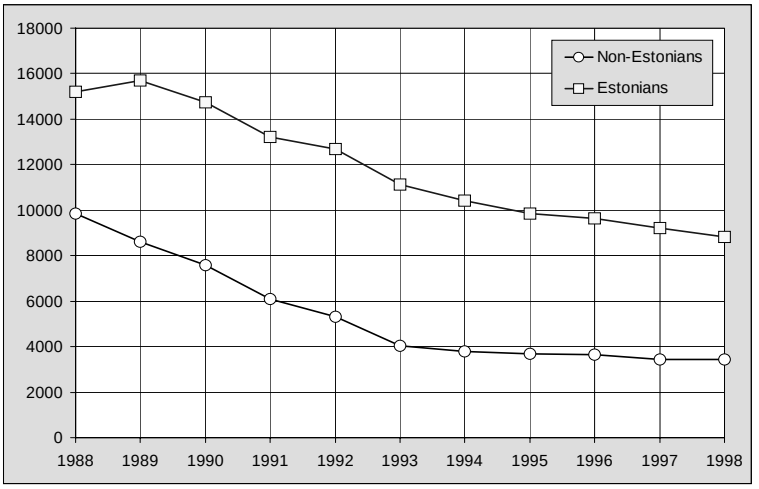

Figure 2: Number of births among Estonians and non-Estonians, 1988–1988

Source: Statistical Office of Estonia

Another characteristic of demographic behaviour, the death rate, had a more complicated trend. Up to 1994 it increased very rapidly, but 1994 was a turning point, and since that year the death rate has been decreasing slowly and life expectancy has been increasing, to return to the level of the late 1980's (Women in Transition 1999).

The problem of demographic changes, especially the decrease of the birth rate, the increase of mortality and shortening of life expectancy is common in all countries of transition of Eastern Europe, especially in the area of the former Soviet Union. Estonia is no exception. During the societal transitions in the early nineties, life expectancy decreased for the both sexes and reached its bottom in 1994, since when a slight increase can be noticed. The life expectancy of men in Estonia is one of the lowest in Europe, being more than ten years less than that of women. The age dependency ratio (ratio of 60+ population to 18–59 population) increased from 29.7% in 1989 to 34.4% in 1998 (Maimik a.o. 2000).

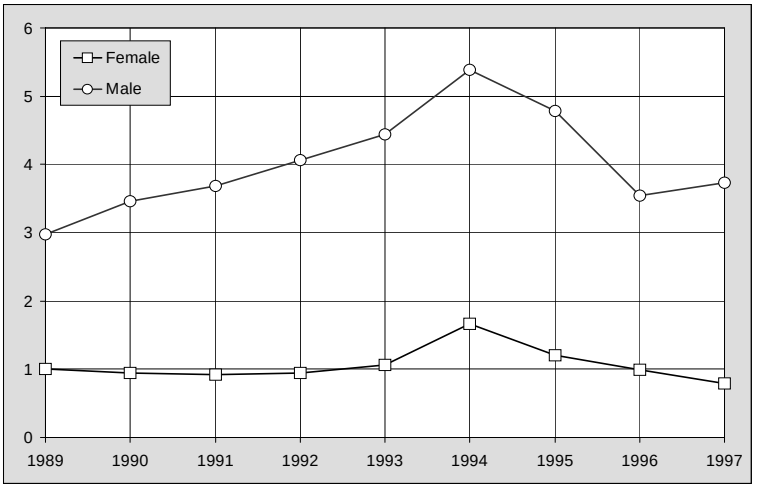

Figure 3: Age 20–39 male and female mortality rate (per 1,000 relevant population)

Source: Women in Transition 1999

Referring to Katus (1999), Estonia long been a country with an ageing population and this process is irreversible. Nevertheless, throughout the post-war period population ageing in Estonia has been restrained. Stagnation of life expectancy at a low level has played its part in this process as well as above-replacement fertility in the 1970–1980s and rejuvenation of the population during that period, but the major component has been intensive immigration into Estonia.

During the last decade, Katus (1999) states, the previous counter-processes to population ageing have lost their importance one after another: fertility has declined fast, immigration has decreased and the rejuvenation of native-born population has come to an end. By now, the decline in life ex-

pectancy has remained the sole component countering population ageing but the persistence of this trend is hardly desirable. Acceleration of ageing, in Estonia is almost unavoidable.

There have been various different factors in this.

- *Women's emancipation, the wish to get an education and realise themselves outside of the home.* The effect of this factor is the decrease of the birth rate. This factor dominated during three periods in Estonian history – the second half of the 19th century (the so-called a*wakening time*), the period of the Estonian Republic (1918–1940) and nowadays, since 1991.
- *The fear that the nation is in danger of survival, political pressure* (plus the lack of opportunity for women to realise themselves outside the home). The effect of this factor is the increase in the death rate. This factor seems to have dominated during the occupations by the Germans (1941–1944) and the Russians (1945–1990).
- *The feeling of psychological discomfort (social stress) in a radically changing societal situation.* The effect of this factor is the decrease of the birth rate (and an increase in mortality). This factor occurred during the economic crisis in the 1930's, and was very strong after the restoration of independent Estonia in the early nineties.
- *The last two factors were selective according to the ethnicity of the population.* In the case of the Russian population the emotional factor of saving the nation did not affect them at all. The factor of social stress influences the Russian population even more strongly than the Estonian population.

From this list we can see that the influence of economic and political conditions on the demographic behaviour of a population is rather complicated and sometimes is not enough to explain some demographic phenomenon. For example, ten years ago demographers were not able to predict so sharp a drop of birth rate in Estonia in the early 1990s and the notable increase over a short period just before that – the late eighties.

A society with rapid societal transitions is reminiscent of a huge scientific laboratory where the processes are accelerated and the results are quick to come. In a situation of societal transition the complexity of different social phenomena becomes more transparent and clear. The links between different fields of knowledge acquire a clearer shape. It can be concluded that the demographic processes in a transitional society seem to show a stronger psychological pattern than ever before. Let us pause briefly on some of them.

Lauristin & Vihalemm (1997) made a periodisation of the stages of societal transitions in Estonia for the period 1987–1997. They pointed out several psychological changes that took place during that period of time. The years 1988–1991 (called *the breakthrough*, or *Singing Revolution*) were remarkable with a spread of high expectations and trust in charismatic leaders accompanied by an outburst of strong national feelings and identification with the common goals. This was also a period of high birth rate among Estonians and feelings of concern about survival as a nation.

The second period, characterised as a stage of laying down the foundations of the Estonian state and launching radical economic reforms (1991–1994), was experienced psychologically as a transi-

tional shock with growing disillusionment on one hand and growing self-confidence, individualism and optimism of young people opposed to the conservatism and disappointment of older generations on the other. Demographically, the most pessimistic data come from 1994 – the lowest birth rate and life expectancy at birth; the highest level of mortality, especially among the 20–39 age group.

The third period of transition (1994–1997) was called by Lauristin and Vihalemm (1997) the stage of economic and cultural stabilization. Psychologically, this was marked by a noticeable decline of national feelings, e.g., growing mistrust in political institutions, increasing cleavages between the life-worlds of people belonging to different strata of society and growing consumerism. In the demographic developments, the trends are returning to the levels known from the pre-transitional period.

Togetherness vs 'otherness'

The unexpected increase in the birth rate, produced mainly by an increase in the number of third children in Estonian families in the late 1980s, can be mainly understood through the togetherness and cohesion of the Estonian population at that time. The confirmation of this conclusion is the fact that the increase in the birth rate did not occur among the non-Estonian population identified as *the others* with respect to the ideal of the independent statehood (Figure 2).

The *Singing Revolution* in 1988–1990 brought together thousands of people (mostly Estonians) to sing, discuss and dream about free statehood, although that still seemed unrealistic. The strong emotional growth during this period filled people with hopes of making these dreams real. This (very rare) factor had a positive effect on the birth-rate and reduced the death rate somewhat, the suicide rate, in particular, dropping notably. The ideal of a high birth rate and the dangers to survival as a nation were given high emphasis by the media. At the same time, reproductive attitudes were undergoing rapid change, especially among Estonian women. In their attitudes towards children and the family, they mainly dreamed about staying at home, getting married and having children in any case, even without a steady partner (Rüütel a.o. 1998). This was the time of searching for one's own social and gender identity and feeling great responsibility for the destiny of the homeland.

Social stress and new challenges

Rapid societal changes overwhelmed people with social stress (Kutsar 1996; 1995). New social problems, e.g. unemployment, poverty and social exclusion, acquired shape during the second stage of the transition and started to affect larger numbers of people and households. New social demands favoured younger people with high human capital (good health, high level of education, open mind, much energy and enterprising spirit, etc). New situations created new challenges, especially for young people. Pluralistic attitudes paved the way for alternative family forms, a spread of unregistered cohabitation and the relative increase of births out of wedlock as a result. The postponement of marriage turned into the norm, as did the postponement of giving birth to the first child (fewer first births among mothers aged 20–29 years).

Learned helplessness and risk behaviour

Increasing mortality rates have been affected by social stress and high-risk behaviour, especially among young men. The social surveys on Health Behaviour among the population in Estonia (1992 and 1994) and Living Conditions surveys (NORBALT I and II 1994 and 1999 respectively), all carried out by the Statistical Office of Estonia, revealed irresponsible attitudes concerning people's own health conditions. There are increasing number of people who are irresponsible about their own health, addicted to work, but unprotected against burnout. The survey refers further to the spreading addictions to alcohol and drugs, high-risk behaviour resulting in a growing number of accidents, to people with health problems who refuse to visit the doctor or to take days off because of the fear of losing their job.

High-risk behaviour and an irresponsible attitude to one's own health have very much to do with learned helplessness, which is a legacy of the paternalistic state. Instead of taking responsibility for one's health, people leave this to somebody else. *But who is that to be? Who cares and who pays?*

It seems that the proper way to explain the demographic behaviour of a population is to use a complex approach, where economic, political and cultural factors are combined with social-psychological explanations. There should be something else important to say *from the bushes* instead of walking up and down under the *street light*.

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DEMOGRAPHY AND BIO-ANTHROPOLOGY

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In the course of their history, the relations between bio-anthropology and demography have fluctuated considerably. The original closeness between the two fields was followed by an increasing divergence in the course of this century, but now a partial and largely unidirectional rapprochement again seems to be emerging.

In modern culture, with its increasing intervention in the basic demographic mechanisms, more attention should be paid to demographic and biological interrelations. By changing mortality, nuptiality, fertility and migration trends, modern culture has not only quantitative but also qualitative – genetic and other biological – effects on the population structure and composition.

Introduction

Biological anthropology studies the temporal and spatial biological specificity and variability of hominids. It deals with the ontogenetic development and phylogenetic evolution of humans and it examines how these phenomena are influenced by and themselves influence the human environment, society and culture (Cliquet 1999).

Demographic dynamics are not only the outcome of the human-specific biogram, but they are also important determinants of the bio-social living conditions of people. The basic demographic variables – mating, fertility, migration and mortality – are the approximate instruments of population genetic changes, ultimately leading to biological evolution. Demography and genetics are closely intertwined: all of the basic demographic mechanisms and processes on the one hand and the population genetic mechanisms and processes on the other hand interact, often in multiple ways (Cavalli-Sforza & Bodmer 1971) (Figure 1).

Modernisation has profoundly changed the demographic dynamics of human populations. Both through the control of mortality and fertility, resulting in the demographic transition, and through changes in mating patterns and migration trends, the modern demographic regime has a profound influence on the biological life course of people and lies at the basis of a fundamental new era in the evolution of mankind (Cliquet 1996–1997).

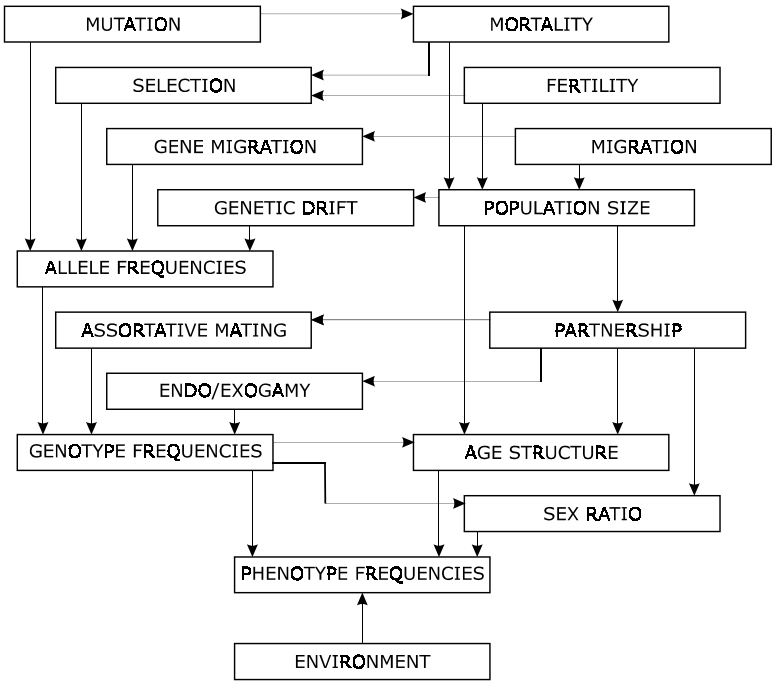

Figure 1: Demographic and population genetic interrelations
(Cliquet 1987; Lasker 1963)

The fluctuating relations between bio-anthropology and demography

Demographers often give the impression of being uninformed or unconcerned about biological-demographic interrelations, and more particularly about the evolutionary-biological background and implications of demographic processes.

This has not always been the case. Earlier and even the earliest population scientists were much more aware of or involved in biological-demographic studies. In 1972 Szabady argued that demography contributed considerably to the development of the biological sciences, but that, due to the lopsided biologistic thinking of some of the 19th century demographers, and the abuse of demography by some 20th century racist anthropologists and geneticists, demography turned its back on biology and moved closer to the social sciences.

The picture must have been more complex than Szabady suggested. The misuse of putative biological theory by conservative and exploitative political ideologies in order to give a natural basis to racist, sexist and classist theories has undoubtedly contributed to the separation of the (anthropo)biological sciences and the social sciences in general, and demography in particular. However, both the bio-medical sciences and demography have, in the course of this century,

developed as autonomous and highly specialised fields with different methodologies, concepts and theories, requiring intensive and enduring specialisation. The intellectual specialisation and isolation were, moreover, strengthened by deep-seated socio-biological behavioural tendencies with respect to in-group/out-group relations and territorial behaviour from which scientists appear not to be exempt. Last, but not least, social scientists are often prejudiced towards biological, and more particularly genetic, causes of behaviour, because they are of the view that biological determinants are immutable and would prevent them from changing or moulding human behaviour according to their ideals and models (Cliquet 1987).

In recent decades, a new rapprochement seems to be emerging between bio-anthropology and demography (e.g. Keyfitz 1984; Szabady 1972). More and more population scientists are becoming aware of the fact that in the study of demographic dynamics, and more particularly in the causal analysis of basic demographic processes, they are dealing with phenomena resulting from fundamental biological pressures such as self-realisation, sexual drives, reproductive strategies, parental investments, territorialism, kinship behaviour, in-group/out-group antagonism, etc. Some even start to realize that the basic demographic mechanisms – nuptiality, fertility, migration and mortality – are the proximate instruments of population genetic changes, ultimately leading to biological evolution. In essence, population is indeed a biologically adapted structure in the chain of biological organisational levels, going from the gene through the individual, the family or kin group, and the reproductive community to the intergenerational continuum. This perspective gives demography, moreover, much more importance than is usually thought.

In bio-anthropology, the rapprochement with demography has progressed much further. In the second half of the 20th century, bio-anthropology was subjected to a major shift from description to explanation and prediction (Lasker 1978; Washburn 1953). Applying evolutionary theory to the phenomena and processes observed, the recording of demographic data in anthropological investigations has become routine, either to study the effects on the genetic structure and composition of populations, or to analyse the influence on ontogenetic processes (e.g. Cavalli-Sforza & Bodmer 1971; Lasker & Kaplan 1995; Spuhler 1963; Young 1971).

The growing awareness of the possible effects of the increasing influence of modern culture on human beings, technologically as well as behaviourally, is very likely to constitute a powerful incentive for the furthering of this rapprochement between bio-anthropology and demography. More and more, modern technology has revolutionised demographic phenomena such as mortality and fertility, and through these processes, they have changed or are changing the phenotypic and genotypic composition of populations. Modern culture also influences other forms of demographic behaviour, in particular mating behaviour, and migratory and settlement behaviour. Changing values and customs result in new behavioural patterns leading to demographic changes and through them possibly to biological changes as well. A salient example is the effect of the demographic transition on genetic population diversity.

The influence of the demographic transition on the genetic population diversity

The demographic transition influences the genetic composition and structure of populations, via all of the major demographic variables – mating, fertility, mortality, migration and population size (Cliquet 1997).

The broadening of the marriage or mate distance has two distinct population genetic effects: isolates are broken up, reducing inbreeding and, hence, diminishing inbreeding depression, and exogamic mating increase, leading to inter-population mixtures and enhanced genetic heterogeneity (e.g. Roberts et al. 1992). Assortative mating on the basis of preferred mate characteristics increases, leading to a higher population genetic variance. The decreasing levels of celibacy may reduce selection intensity and increase genetic heterogeneity (e.g. Epstein & Guttman 1984).

Changes in fertility – timing as well as intensity – may have different effects. The avoidance of births at higher ages lowers the frequency of genetic impairments the incidence of which is correlated to parental age. The practice of selective abortion has the same effect, but may, in the long run, raise the equilibrium level of harmful recessive alleles due to reproductive compensation (e.g. Evers-Kiebooms 1994). Although IQ-related differential fertility is decreasing, the demographic transition seems so far to have had a slight contraselective effect (e.g. Retherford & Sewell 1988).

Mortality reduction results in a selection relaxation. Improved living circumstances of all sorts and medical replacement therapies allow more and more frail individuals to survive and even to reproduce. This results in a selection relaxation, but at the same time in an increased adaptability of persons who would not have lived long. The increased survival rates are associated to an increase of biological frailty, and, hence of genetic heterogeneity (e.g. Adams & Smouse 1985; Manton et al. 1990).

Increasing migration flows also enhance population genetic heterogeneity. In combination with increasing population size, they break up isolates, decrease consanguinity levels, and hence lower inbreeding depression. The present increasing trends in migratory movements and exogamic behaviour have stopped the earlier fission in favour of an increasing fusion movement (e.g. Bogin 1988). Modern culture may have strengthened selective migratory processes, e.g. by means of the brain drain.

In the future, it can be expected that the demographic transition, mainly through the experience of mortality and fertility controls, will contribute to shifting population policies from quantitative to qualitative goals, and from phenotypic to genotypic concerns (Cliquet 1996–1997).

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DEMOGRAPHY AND HISTORY: A MATTER OF ELECTIVE AFFINITIES

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Introduction

While historical science has very remote roots going back to Herodotes and Thucydides, and demographic thought appeared at about the same time, demographic science was born much more recently, at the end of the 17th century. And while demographic thought very early, with for instance Montesquieu at the beginning of the 18th century, referred to history, and conventional history could not help referring to population matters, it was only after World War II that this relationship was actually settled. My purpose is therefore to address the question why, when and how these two human and social sciences recognized their reciprocal links and then to delineate the way they now work from this point of view.

Accordingly, I shall consider the state of classical or traditional history from the end of the 19th to the beginning of the 20th century; the mutation or revolution this learning underwent from the end of the twenties, partly under the influence of Marxism, and which primarily affected social and economic history; the first attempts which were made around the 1940s to formalize and to apply new historical principles to the study of population problems; and then, from the fifties, the officialization of this connection and the practical applications of history to demography, and of demography to history. I shall end with general considerations about the debate concerning the usefulness or the purely gratuitous character of historical research, which seems to be not relevant in the case of demography.

In this short outline, I shall mainly consider what has occurred in France, not only because I am more acquainted with the evolution of history and demography in this country, but above all because it was in France that the links between these disciplines were the most precociously established and it was France which gave birth to historical demography.

From the war of 1870 to World War I: mutual indifference

As was seen by classical historians during the 19th century, history was above all the history of the State, the Nation and great men. It was an ideological and nationalist discipline which, as François Furet stated, drew up genealogies, subordinated space to time, rested on narrative, and denied the gathering of facts.

During the period 1870–1920, it was the so-called *methodical school* which prevailed. Relying on the exploitation of scarce documents, advocating very strict techniques, the *methodical* historians remained very cautious as to generalizations and most of time they forsook any synthesis or interpretation. What was later called *historizing history* was mainly history interested in *events* or peculiar facts, and in the short run, or *short time*. Classical historians went on favouring political, military and diplomatic history and neglected economic, social, cultural and of course demographic phenomena. There were naturally some exceptions. Without going back to Voltaire and his *New Considerations about History*, one may quote the histories of the French population by Emile Levasseur or Lucien Schöne, who considered demographic, social and economic features; or the research undertaken by Jean Jaurès on the economic characteristics of the French Revolution. But as Pierre Goubert noted, French historians were concerned about population problems in a very irregular and superficial way. Some of them (Sée 1924) even asserted that it was impossible to study and to understand the latter. History went on frequenting Fine Letters, Morals and Politics. From time to time, some more curious historian wondered how many inhabitants such town or such country might have had, but this approach remained incidental and occasional.

From the other side, demographers' interest in history was equally weak. While other sciences had broken into the universities (like economics in 1877), demography had forked toward administration, and had settled into official statistical bodies or institutions which supplied them the data they desperately needed. Moreover, driven as they were by their greed for short run action, they were incited to think that the past was dead forever and that to know about it only helped to satisfy our curiosity. While demography of the present was an essential tool for action, historical demography remained for them a simple curio, without any practical usefulness.

The revolution brought by the *Annales*

It took a long time before this situation was unlocked. Things had nevertheless begun to change as to history, with the rightly named *Review of Historical Synthesis* founded in 1900 by the philosopher Henri Berr, and above all with the creation, in 1929, of the celebrated *Annals of Economic and Social History*, by the great historians Marc Bloch and Lucien Febvre; with the first attempts at an economic history by the French sociologist François Simiand, who was an adversary of history but was a forerunner in his wish to bring together sociology, economics and history, in his methodological conception of economics, which had to proceed by induction from facts and in his systematic use of statistics. Economic history began with the history of prices, wages and income by F. Simiand and then Ernest Labrousse.

Parallely the editors of the *Annales* tolled the bell for traditional history and celebrated the birth of *new history*. This step was inspired by their criticism of the methodical school, which they reproached for its inability to proceed to generalizations and to advance bold interpretations. With the *Annales* school, the prospects were reversed: the favourite object of history was no longer the State or the Nation, but individuals, families and society. Instead of telling the great men's story, historians studied the history of anonymous or unknown people in Europe, then the

history of the so-called *populations without history* overseas. Instead of making the story of One, the aim was to one would make the history of All, or Everybody. The historians of the *Annales* endeavoured to throw light on the economic activity, the social organisation and the characteristics of collective psychology, Marc Bloch, himself specializing in comparative history and Lucien Febvre in the history of mentalities. They insisted on the long run and the repetition of facts and they advocated bringing history together with other human sciences, such as economics, geography, sociology or anthropology. As to demography, which was not explicitly but implicitly included in this list, the link was to be made by a man who played a very important part in the progress and the institutionalization of demography in France: Adolphe Landry.

The junction of history and demography: the part played by Adolphe Landry

Adolphe Landry (1874–1956) was a sociologist, a demographer and a legislator, who described himself as an *occasional historian*; but even if he never really exposed his conception of history as a specific discipline, he had some definite ideas about it and went on developing them throughout his intellectual career (1906–1945), beginning with the limited and subordinate role he granted to history in economics, and ending by the prevailing one he gave it in demography. For Landry, to do historical work was to tell, to describe, to enumerate past facts and so to gather materials in order to build economic science: it is science which will identify static and dynamic laws from the facts collected by history. In 1906, as he wrote about the German and Austrian economic schools, he considered the importance of historical studies, which consist in the observation of facts and above all of complex facts, as to the various kinds of research. But he did not disown the importance of particular facts which make it possible to understand individuals' incentives and behaviours. What did he see as the advantages of history? First – and here Landry pointed out one of the most often quoted interests of history – it satisfies our curiosity about the way our ancestors lived, it provides a more or less vivid *pleasure*, and it even incorporates a *dramatic interest*. Secondly, history represents a stock of materials which are used to discover or to check laws. Thirdly, when it considers the present, it identifies practical problems to solve. The present belongs to history, and historical knowledge may make it possible to predict the future with some probability. Finally, historical knowledge may in some measure take the place of scientific knowledge. But it is science which has to research laws from the facts gathered by history.

Critics of the historical school: the subordination of history to economic science

At this stage of this thinking, Alfred Landry criticized historicism, which asserted that the historical study of facts may allow us to define laws of development. For Landry, these laws are not real ones, because they are not general and *science is only general* (or science is but general). There are no universal or absolute laws in the economy because they are always related to a specific historical stage and are always limited in time and space. Landry seemed here to adopt the Marxian attitude rather than the Malthusian one.

Landry criticized the historical school, which mainly favoured descriptive and statistical works. History is interested in *the succession of facts.* It does not consider very limited objects, but complex and broader sets. Landry, who was against the accumulation of *fragmentary (or peculiar) facts*, advocated the collection of *a mass of similar facts* which would make it possible to obtain *figures applying to aggregate sets* (ensembles). But he did not deny the utility of particular facts for obtaining information about individuals' incentives and their demographic behaviour. One cannot number facts without trying to explain them. The study of *peculiar facts*, that is historical study, is necessary to give an idea of the relative importance of various factors. Effectively, history has not to limit itself to understanding facts only from their qualitative side, but also from their quantitative one: history has to describe *and* to number.

At the beginning, Landry applied these principles to economic science: for this discipline, history is interesting as a curiosity, it tells about practical problems, it contributes to the formation and to the application of economic science, and may eventually compensate for scientific knowledge, but he thought at that time that history was not important in itself, even if historical work is often preferred – because it is easier – to scientific research or investigation. History does not explain anything, it limits itself to observation. It does not supply general knowledge, but only accumulates materials. Consequently Landry concluded that historical learning has a subord-inate status.

The influence of the *Annales*

But from the thirties, under the influence of the *Annales*, Landry's conception of history completely changed. What might have been his relationship with the new school ? When he was a student at the Ecole Normale, his teacher for Roman history, who deeply influenced him, was Gustave Bloch, the father of one of the *Annales'* founders. At the Ecole Pratique des Hautes Etudes, where he taught the history of economic doctrines from 1907, one of his colleagues was the future father of economic history, François Simiand, one of his fellow students at the Ecole Normale, who had met Lucien Febvre very early and was very akin to him. And last but not least, one of the members of the editorial staff of *Annales* was the sociologist Maurice Halbwachs. Indeed, Landry never published any paper in the *Revue de Synthese* or in the *Annales* themselves and he did not participate directly in the debates. But from the 1930s, his vision of history seemed to have been clearly influenced by the *Annales.*

Demography as history: its specific methods

Henceforth, history acquired for him the status of a genuine specific discipline, and, what is more, he bestowed on it an essential part in demography. In his founding text book (Landry 1945) he was no longer concerned about its limits. The first chapter was dedicated to *demography as history*. *In the first place, the question is to know facts*, and from this point of view, demography will be history, because all the facts we discover belong to the past, even those which are said to belong to the present. Therefore Landry asserted there is a *historical demography* (at

that time, this meant *demographic history* or history of populations) which is a division of general history, exactly like political, military or religious history. A specific status is therefore recognized for history as such, but demography will be at the same time history and geography, for demographic phenomena occur within time and space, and this discipline will have links with sociology and economy. This is a typical Annalistic principle.

Gradually the study of facts, the quest for laws, and the research of the factors which are responsible for the variations of demographic phenomena will give birth to a pure or rational demography. This part of demography, which studies the mechanism and the action of main demographic factors and which will deserve the name of science, will display great usefulness, at the same time from the historical point of view, for the explanation of the demographic past and the understanding of the present, and in prospect, for forecasting the future.

What methods will be common to demography and economics? The deductive method, which consists in drawing new propositions from propositions known to be true or supposed to be so, is undeniably preferable in economics to the inductive method, which is practised by the historical school to determine laws from the observation of complex facts. But these laws will always remain abstract truths, they will never supply a complete explanation of reality, and they will never make it possible forecast future with certainty. This inductive method remains inferior in economics as in demography. Landry concluded that the method which will allow us to build economic science would be at the same time inductive and deductive. The other common tool of pure economic science and demography is statistics, that is, the set of methods which may be applied to the numerical study of mass phenomena. Born with the constitution of the big states, institutionalized when the French Revolution endeavoured to give a rational organisation to the state, statistics does not measure, it counts. And it is to demography as history that it is the most useful: demography as history effectively relies on it; it would practically not exist without it. If it was separated from statistics, history could not draw sure inductions, for it does not supply precise numerical information. But this necessary tool is not sufficient; for instance, it absolutely cannot explain men's reproductive behaviour. However statistical demography could appear only when sufficient materials were available.

From speculative to didactic history

Demography is therefore more deeply anchored in history than in economics. From being purely speculative at the beginning, history became gradually didactic, displaying itself as a requisite guide for collection, analysis, interpretation and action. Landry considered the part played by history at every step of demographic thinking, leaning on the archeology of the past in order to prospect the future.

Demography effectively includes many divisions: as history, it collects facts belonging to past and present; as theory, it endeavours to give an explanation of facts; as doctrine, it passes subjective or value judgements (*jugements de valeur*); as politics, it seeks for means to influence demographic trends. So at every step, knowing, understanding, evaluating, modifying, Landry intro-

duced the intervention of history. We may say that in 1945, immediately after World War II, answering the requisition of the *Annales*, Landry started the full programme of future historical studies in demography: the history of statistics; history of populations or demographic history; history of theories; history of doctrines and of authors; history of politics. The only discipline he did not forecast at this time was *historical demography* in the modern meaning, which had to be created a little later. Historians on one hand, demographers on another, had only to pick up what was suggested to them, to definitively seal the alliance between their formerly distinct disciplines.

Landry himself made a significant contribution to both disciplines when he drew up his concept of demographic revolution – which had to give birth to the theory of demographic transition – from the study of three essential periods in the past: the depopulation of the Greco-Roman world in Antiquity; the emancipation from traditional ideas about individuals and family during the Enlightenment; and the political revolution of 1789 which definitely introduced the change of reproductive behaviour. *"To study what happened in the demographic field during ancient times is the means for seeing the demography of present times more clearly and to better appreciate it"* (Landry 1934).

The legitimisation of the *love affair* between history and demography from the 1950s

Mainly thanks to Landry's book, which was published the same year when the French National Institute of Demographic Studies (INED) was created in 1945, just after the war, things had begun to move: demographers happened to be interested in history, and historians in demography. For the former, an essential part was played by the statistician Alfred Sauvy, who was deeply influenced by Landry, and who was led by him (as well as by the reading of the books written by the American J.J. Spengler) to give a significant place to the history of facts and the history of ideas in the multidisciplinary research programme of I.N.E.D. (Let us remember that Sauvy had participated in the *Treatise of Demography* and that, when he was named director of INED, Landry was at the same time named President of the Administrative Council of the Institute.) Under their common auspices, the first volumes of the Collection of Demo-economic Classics were published during the fifties (Cantillon, *Economie et Population*, I and II). And as early as 1946, Jean Meuvret, the founder with Ernest Labrousse of the French school of quantitative history, who had undertaken a large survey of the history of prices (along the lines begun by François Simiand) and who had noticed a relationship between the rise of corn prices and the rise of mortality, published in the review of INED, *Population*, a resounding paper about subsistence crises and the demography of France under the *Ancien Regime*, which stimulated many historians to prospect an unexploited mine: the data included in Church records.

The historian Pierre Goubert proposed as early as in 1952 to gather on a card all the information dealing with the constitution of a family. From 1953 the demographer Louis Henry began to devise a strict method of analysing and dealing with former marital status on standardized cards, and in 1956 he published a book about relying on genealogies in the study of demographic behaviour of old Geneva families from the 16th until the middle of the 20th century, which led him

to the very core of historical problems, upper class demography becoming an important feature of the political life of the city during this period. And in 1958 he started his great survey of the history of the French population since Louis XIVth.

In a different field, it was at this time that the historian Marcel Reinhard published the fundamental book on world population history (1949). Some years later, in 1963, with André Armengaud he created the *Society for Historical Demography* which published a specialized review named from 1965 *the Annals of Historical Demography* (a title inspired by the *Annales* of Febvre and Bloch?). In 1967, Reinhard constituted a team for historical demography which became in 1973 the Laboratory of Historical Demography depending on the VIth Section of the Practical School for Higher Studies which had been founded by M. Bloch.

The trend which had begun in the 1950s accelerated from the sixties. At this time all the main initiatives in the common ground between history and demography had been started and at each step, one might recognize the remote influence of the *Annales*, passed on by men as Landry or Labrousse and expressing itself through the choice of topics and through the choice of instruments. As A. Van der Woude stressed, by establishing their positions within history and demography during the 2nd half of this century, population history and historical demography have allowed a real breakthrough in historical research. And it was the French historians and demographers Goubert, Meuvret, Reinhard and Henry who during the fifties settled the status of research in the history of populations, a status it has maintained ever since. One of the main contributions of historical demography to history is to have supplied this latter with quantitative information. And it seems that the double risk which was formerly denounced some twenty years ago, that is of the historical incompetence of the scientists and the scientific incompetence of the historians, may be in this way at least avoided.

The history of demography: its main divisions

Not only were the lines of action proposed in 1945 by Landry scrupulously followed but some new fields in historical research were gradually added to the primitive schema. We may quote from them: the history of concepts, theories and doctrines and the history of authors, of their lives and of their writings (the catalogue of the Classical Collection published by INED speaks for itself). The history of demography itself, that is of population science, was made possible by the publication or reprinting of unknown works, completed by critical commentaries about their sources and their methodology and by the analysis of the intellectual and administrative background of their respective times of writing. The history of statistical sources, of the Church records and of the numbering undertaken by the royal power, the universal subjection of men being realized within the frame of the Empire. The history of institutions and organisms, a conference organised by INSEE in 1975, history of INED, of the Statistique Générale de la France, of the Bureaux of Statistiques, of the International Union for the Scientific Study of Population (IUSSP), of the Foundation for the Study of Human Problems and so on. The history of tools and of implements (the notion of life expectancy, life tables, life annuities, ratios, method for families reconstitution, and so on).

The methods of political arithmetic in the 17th century heralded those of historical demography in the 20th. In both cases, Jacques Dupâquier asserted, one has to take up the challenge thrown by the sources (bills of mortality or the church records). According to him, political arithmetic would be an answer of scientific free enterprise to official administrative failure. Until 1800, political arithmeticians seemed very isolated. They were often astronomers, physicians or clergymen who saw in statistical regularities the proof that God existed.

The contribution of historical demography to history

But it was a new discipline, historical demography, which led a set of historians to become more or less demographers. As P. Goubert and P. Chaunu asserted, in our time, every genuine historian has to be a demographer; *"an historian in our time almost always ends in by being a demographer"*. The contribution of historical demography to general history is significant, both from the conceptual point of view, and from the knowledge of some peculiar facts or situations. First of all, as Dupâquier underlined, it led to a questioning of the relationship between economics, demography and society. According to P. Chaunu, it appears that behaviour is more geographical than social, more communitarian than economic. For Dupâquier himself, the weight of social antagonisms upon the demographic destiny of population was probably not the same in the 17th and the 18th as in the 19th century. It is not very probable that social situations are themselves wholly reflected in demographic behaviour. The opposition *town versus country* was as geographical as social, as was the differential mortality between the parishes of a same town. While until recently it was generally admitted that the economic revolution had preceded, prepared and conditioned the demographic revolution, gradually a new conception emerged, according which population growth always played a leading role in the evolution of agrarian societies: it is demographic pressure which urged men to change their way of life. It is not technological innovation which blows up the reproduction frame, it is the growth of human reproduction which gives birth to innovation.

In the line defined by the School of *Annales*, historical demography made a particularly wide contribution to the advancement of social history, that is to the history of ordinary people, peasants or others, those *very ordinary people* forgotten by the old academic and elitist history. Historical demography at last provided a representative picture of French society while other sources gave only a biased picture of it. For Dupâquier, one can imagine that in the future demographic data might constitute the framework of all social history studies, in particular thanks to this *wonderful tool*, i.e. the method of reconstituting families. The level of observation would thus continue down to individuals and to families and review social history again through a microscope.

From the 1960s, historical demography also gave a strong basis to this history of mentalities warmly advocated by the school of the *Annales*: for instance, the analysis of the monthly or daily trend of weddings may tell the historian of mentalities something about the depth of religious feelings, as is the case with the monthly trend of births and through it of conceptions; in fact this trend would reflect less the frequency of sexual intercourse than the seasonal variations of feed-

ing or those of intra-uterine mortality. The history of mentalities is situated on a common ground between history and demography. Michel Foucault was convinced that changes in a society depend on the transformation of our mental structures. From the 1970s, publications about this matter became more and more numerous, while Philippe Ariès, for instance, explored, from his side, this intermediary area between biological and mental attitudes, for example, towards childhood, life, death, sexuality, contraception, etc. One of the major problems studied by the new demo-historians is indeed the motivations or incentives of the trend toward the *voluntary sterility* which took place in French society above all from the end of the 18th century. Neither demographic calculations or statistics can explain this trend which reinforced the effects of belated marriage, this sexual asceticism which is one of the keys to the Western advance.

In speaking of the voluntary limitation of births, the chronology and the extension of this phenomena have to be more detailed. It did not mean perhaps a real change of families' attitude to life, and the movement became really effective only at the extreme end of the century and influenced central areas in particular. It is difficult to agree about motivations: the division of family estates? The appearence of a new conscience and a new knowledge of one's body? The weakening of religious feelings? The disruption of the revolutionary departure in the years 1797–1799 without any return to the old system of values? If the men of the Revolution were populationists, paradoxically it was a Malthusian population which emerged from the great upheaval.

Historical demography still contributes to the history of mentalities, for instance, by the study of the frequency of signatures in the Church records (only the signature at the first wedding is significant) which gives us an idea about the spread of learning and of literacy. The studies of historical demographers allowed also us to get rid of many *received ideas* (prejudices or *clichés*) in matters of population history. The frequency of illegitimate births was only about 0.5 to 2% in French villages during the 17th and the 18th centuries, and it showed an upwards tendency during this last century. But the interpretation of this phenomena is delicate. The frequency of prenuptial conception, which varied only between 4 and 16 %, is a good testimony that the population of this time faithfully obeyed the orders of the Church, and that literature about illegitimate births and about the libertine tendencies in high society gives an untrue idea of the morality of the different classes.

But the main contribution was certainly the quantitative method demography brought to history, thanks to the use of mathematics and of statistics and thanks to the exploitation of counting and of Church records, etc. History is not the last science which has the right to a Muse, like astronomy. Numbering is not the only scientific method it may apply, there is also the philological study of texts, and so on. Landry had already pointed out the necessity of statistics for history, if this latter wanted to be no longer an art, but a science. And as Louis Henry said: *"Historical demography is a technique put at the disposal of History and which gives it the maximum of rigour and of solidity"*. Some authors even expressed their fear that demography would become too technical and overly specialized, and that it would let itself swamped by the quantitative approach. The appeal to history, which allows a broader vision, would doubtless be a protection against this risk.

Pleasant or/and useful?

For decades a debate agitated the milieus which were thinking about the status and function of history: did this discipline only offer a purely speculative pleasure, or did it present any specific utility? Did it only aim to satisfy our intellectual curiosity, or did it offer any help for practical action? The Dutch historian Henk Wesselling insisted on the immediate pleasure offered by historical research or what he calls the *historical sensation* or feeling. The works of great historians bring a new vision, new fields or approaches and new techniques (borrowed from economy, sociology or anthropology, and particularly the use of quantitative sources). He concluded that history may reveal itself to be useful, but that anyway making history or reading it always remains a pleasure.

As acceptable as this conclusion may appear to us, it seems nevertheless slightly limiting because we hope to have demonstrated, with the case of historical demography, that history is at the same time pleasant *and* useful. We may apply here what J.A.S. Schumpeter came to say about the history of economics or of any discipline in general. According to him, this activity offers three kinds of advantages: it inspires new ideas and formulates very stimulating propositions; it unveils the way the human mind works; and it sheds light on the process of connections between scientific ideas. We completely agree with this point of view. The function of history is not only to allow us to understand (*Verstehen*) the past and the present. As the English novelist L.P. Hartley stated, *"the past is a foreign country; they do things differently there"* (Wesseling 1999), and history may help us to understand these ideas and behaviours which are so far from us now. It also allows us to prospect the future, as Landry had already stressed and as many modern historians assert. Indeed Emanuel Le Roy–Ladurie goes on to say that: *"to study the history of the past is to learn the present"*, or that *"the past conjugates itself in the present"*, but A. Farge also recognized a role of anticipation for history. Any consideration about the future cannot be isolated from the weight or the memory of history. Without the work of historians who inscribe the data from history in time and in space, the memory necessary to build the future cannot be used. All modern historians insist on the fact that history does not allow us only to understand the present, it also allows us to forecast, in some way, the future.

Against all these lovers of Clio, Hegel said a terrible thing about history. For him, *"history is the science of men's misfortune or misery"*. So, would it be, like economy, a *dismal science*? We incline rather to what a French historian, an heir of the *Annales*, said, like Wesseling: *"There is happiness in history and we all know happy historians"*.

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DEMOGRAPHY AND ECONOMICS

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(1) Demography and economics are scientific disciplines which study reproduction. The first studies the reproduction of the human population, while the second deals with the reproduction of the economy. From this point of view the two disciplines are close relatives, especially if we take into account that the human population is an important element of economic reproduction. People are those for whom the economic activity is intended, and, at the same time, the active population or aggregate labour force is, via labour, probably the most important factor of production.

However, if we define economics from the microeconomic point of view, which is the most important or main stream definition, for many economists reproduction is a word which is hardly mentioned. The MIT Dictionary of Modern Economics defines the economics as *"the study of the way in which mankind organizes itself to tackle the basic problem of scarcity"* (Pierce 1992, p. 121). For microeconomic oriented economists the demographic phenomena are obviously less important and less interesting.

This basic contradiction of the definition of modern economics is, from the economic point of view, the most important reason for the dilemmas which govern the relations between the disciplines of economics and demography.

The second part of the story has much to do with the different definitions of demography. As in economics, there are narrow and broad definitions of demography. The narrow approach sees demography as the study of demographic processes and structures, which do not have very much in common with the economics. However, if we define demography from the broader perspective, more from the perspective of population studies, the story is completely different. The broader definition also deals with the relations between human population(s) and its (their) economic activity and social organization.

(2) In both everyday professional life and scientific literature it is possible to find economists and demographers from both of these two groups. A very important question is, however, which of the two groups, the narrower or the broader, is more important for the development of science in general and for our two scientific disciplines in particular.

The author of this paper is very much in favour of more broadly oriented definitions of demography and economics, in spite of criticism on the ground of a lack of specialization. The group with broader views is the only one which can contribute to the development of the relations between our two scientific disciplines and to the enriching of one with elements and theories of the other one.

(3) From the historical development point of view it is possible to see that economics and demography share a great deal of common history. For centuries they were included with other social sciences under the broader cover of philosophy. Later, when economics had developed into a particular scientific discipline, it covered many important demographic questions. Over the last century, when the two disciplines have been separate, they have still shared important mutual influences. Generally, it is possible to identify periods which have seen very fruitful cooperation between economics and demography, and, on the other hand, periods when the two of them have been very much separate.

There is extensive scientific literature which bears witness to this. More generally, it is quite evident that both disciplines have usually been under the strong influence of the development of human population(s) and economic, social and political developments in different periods. Broader economic and demographic circumstances have always been very important for particular issues that have been important in different periods. It can probably be said that fashion has also been an important element in the scientific development. In the second half of the twentieth century, therefore, many of these elements and mutual influences between economics and demography have been strengthened and have enriched both of them.

(4) Returning to the origins of the modern economics it is possible to see that population has played an important role. It was incorporated into classical economic theory, but authors of the theoretical system did not differentiate between total population and its active part or aggregate labour force. In the classical view, Malthus' law of population, in the combination with the iron law of wages explained, according to the classical view, the supply of labour in the economy. Malthus' law of population was understood for more than half of the nineteenth century as a natural eternal law.

(5) The second half of the nineteenth century witnessed the so-called *marginalist revolution* in economic theory. The founders of the new theoretical framework used marginal analysis to analyse the pricing of goods, services and factors of production in competitive markets. The basic idea was a perfectly competitive economy where the market prices of goods and factors of production were related to their scarcity. The microeconomic approach maintained that the prices of commodities were derived from individual rational maximizing behaviour in markets (Pierce 1992, p. 301).

In the new system population law was abandoned. The marginal utility principle did not depend on any particular assumption about fertility and mortality rates. Therefore, economic theory lost much of its interest in the population and its development (Schumpeter 1975, p. 754), and instead, a new scientific discipline – demography – emerged. Later, especially in the first half of the twentieth century, economists hardly discussed important demographic questions. An important exception was the optimal population discussion, but this was not very fruitful and the optimum was hardly envisioned. Gunnar Myrdal described it as the most sterile discussion he had ever heard (1940, p. 26).

It is clear that for almost a hundred years economic theory lost its interest in the population, largely due to its microeconomic orientation, the domination of marginalism and neglect of development problems (Malacic 1982, p. 282).

(6) In the 1950s economists rediscovered, both in theory and in their practical empirical work, the theory of population and the demographic problems. J. Schumpeter wrote about the phenomenon in his very known book about history of economic analysis (1975, p. 487). The rediscovery was mainly connected to the social, economic and political changes in the period immediately after World War II. Economic theory in this period discussed topics like economic development, macroeconomics and the newly emerging problems of the third world countries. In this context population development was one of the key issues.

(7) The population growth caused by a specific stage of the demographic transition revitalized the ideas of Malthus. Papers, books and scientific conferences have tried to show the importance of Malthus' ideas (Dupâquier 1983), in spite of the fact that some authors, like M. Blaug, completely denied any relevance of Malthus' population theory to the second half of the twentieth century (Blaug 1964, p. 71). Blaug's position seems convincing if we recall the nonexistence of natural eternal laws of population. Population reproduction is a socially modified biological phenomenon which has nothing to do with unchangeable eternal population laws.

(8) The second half of the twentieth century has also been marked by the theory of demographic transition with its important economic causes and consequences. This has very much to do with the relations between demography and economics, but as the theory is widely known, there is no need for further elaboration on this topic.

(9) An important development is visible in the field of economic demographic modelling. The core of the modelling deals with the causes and consequences of the economic demographic relations. The array of models is very broad. However, the models started with an analysis of more classic economic demographic relations, such as output growth and employment, demographic implications of savings and investments in physical capital, etc. Later, they reoriented, in accordance with new topical issues in economic development, in directions which stressed the importance of education, human capital formation, entrepreneurship and innovations.

(10) More recently, probably the most important contribution of economic theory to demographic knowledge is the economics of fertility. The basic idea was expressed by T.W. Schultz, who stressed the importance of prices, costs, incomes, human capital formation, and some other economic phenomena for human reproductive behaviour (1973, p. 54).

The economics of fertility is simply an application of modern microeconomic theory to the explanation of the fertility behaviour of human beings. The theory considers children as a durable consumption good which is assumed to provide utility. In the framework of demand analysis, then, a family must determine how many children it will have and the amount spent on them. Family income is the determinant of the quantity and quality of children, although the elasticity of quantity is rather small compared to that of quality. Children must be produced at home and each family tries to come as close as possible to its desired number of children (Becker 1960).

During the 1960s, the 1970s and the 1980s fertility economics was broadened to the economics of the family. The use of modern microeconomics and some other economic theories has been widely accepted by the growing number of authors in fields of demographic research like migration, infant and child mortality, the economic roles of households, etc.

(11) The scope of economic research interest in demographic phenomena has increased tremendously during the last decades of the twentieth century. The economic causes and consequences of demographic developments in developed and underdeveloped countries have been broadly studied. Human beings' economic behaviour is closely connected to the types and characteristics of the families and households they live in. Furthermore, there are important consequences for state policies in social networks and redistributions. It is worth mentioning that a *Society for Population Economics* (ESPE) was established in Europe in the 1980s. Under the auspices of the ESPE, the *Journal of Population Economics* has been published by Springer since 1988. Unfortunately, there is still a lack of collaboration between ESPE and traditional unions of demographers (IUSSP and EAPS).

(12) Connections between demography and economics can also cover more business oriented topics. This is very much in accordance with the continental European university tradition, which still unites economics and business education in schools of economics, in spite of the different Anglo-Saxon practice. A very good example is the demography of firms, which applies basic demographic methodology to the births, lives and deaths of the business firms. Generally, however, European demographers are still much less business oriented than their North-American colleagues. Meetings of the Population Association of America very frequently have business topics on the agenda and L.G. Pol even titled his book *Business Demography* (1987). Most of Pol's book, however, is a classical demographic textbook, but the title somehow shows the trend in the discipline and certain broader economic and social influences. Globalization will, very likely, help to reorientate European demographers in the same direction in the future.

(13) The long-term historical approach which has been chosen for this survey of the connections and mutual influences between demography and economics has also been selective. The selection of topics is, by its very nature, individual and subjective, and other authors would have chosen topics more or less differently. However, the basic conclusion on the historical development of demography and economics would have been the same. Namely, the developments of both scientific disciplines have been connected and have resulted in important theoretical and empirical findings. It is possible to find similar mutual interdependences between other social sciences too. M. Rabin has recently reported about new research in links between psychology and economics (1998). The paper has stressed the importance of the continual incorporation of new knowledge in the bodies of our sciences. All this proves that more broadly oriented social scientists have made important contributions to the treasury of our knowledge.

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DEMOGRAPHY AND GEOGRAPHY

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In discussing mutual relations between geography and demography, one has to keep in mind the changing definitions of both disciplines as well as different approaches to the subject. Furthermore, differences in definitions and approaches may have been due to national traditions and specific schools.

Geography has always been characterised by an emphasis on the spatial dimension. This was true when regional schools predominated, this has also been true when the paradigm shifted and a topical or systematic approach gained in importance. Description and analysis of regions on various spatial scales, so typical for the old regional school, has always included references to population and its impact upon cultural landscape. Population size, distribution, density, as well as its changes and characteristics, were analysed in relation to other aspects of a given region including both environmental and societal variables.

On the other hand, attempts to identify a separate branch of geography dealing specifically or mainly with population data from the late 19th century, when the term *Anthropogeographie* was coined (Ratzel 1882). The separate identity of population geography under the name *Bevölkerungsgeographie* was set by another German geographer in a bibliography published some half a century after Ratzel (Dörries 1940).

While various aspects of population were studied by different geographers in the interwar years, it was really after World War II that attempts were made to define population geography as a separate sub-discipline. It was a French geographer, Pierre George, who first published a book in which the term *géographie de la population* was used and the subject defined (1951). He argued that the specificity of geographical method requires that the elements under study, including population as well as other variables, be area-specific. Hence the importance of maps, including population maps, which have always been a favourite tool of geographers.

A different, if not contradictory view was expressed by a recognised authority in American geography, Glen Trewartha, who argued that *"Population is the point of reference from which all other elements are observed, and from which all, singly and collectively, derive significance and meaning"* (1953). This view was later shared by several authors, whether specializing in population geography or adopting a broader approach.

It was in the 1950s and 1960s that a world-wide trend of treating population geography as a separate discipline became clearly noticeable. Monographs, bibliographies and textbooks were appearing in different parts of the world and while their authors may have represented different schools, their focus was on the geographic study of population.

While it was not possible to present here an exhaustive review of literature, mention can be made of some European and American authors who were quite active and influential at that time (Zelinsky 1962 and 1966, Korčák 1963, Pokshyshevski 1964, Clarke 1965, Beaujeu-Garnier 1965, Kosinski 1967).

As early as 1959, Edward Ackerman reviewed the relations between geography and demography in a chapter of a widely quoted compendium edited by P.M. Hauser and O.D. Duncan (Ackerman, 1959). After reviewing the field, he concluded as follows*: "Geography treats areal differentiation, and all significant areal differentiation has a time dimension. A near universal characteristic of space-relation patterns on the earth is constant change… Demographic movement is at the heart of these forces which influence the change in space context."* And further, "*In the future, geographic research is likely to proceed on the assumption that the cultural, physical and biotic worlds are something of a continuum for the understanding of space relations. However, disaggregative research stressing quantification may be most influential in determining the future direction taken by the discipline. In this the data and interpretations of demography will be very important to geography. Geography, on the other hand, will aspire to illuminate the scene on which population growth and decline runs its course"* (ibid., p. 724). While not all of Ackerman's predictions came true, the emphasis on quantification and close relations with demography were closest to the mark.

Two research areas were of particular interest to geographers – population distribution and migration. Both acquired an international dimension when the International Geographical Union created a special commission, which has existed under different names within the Union since the 1930s (Kosinski 1980). Population geography was analysed specifically by Witt (1971).

Population geography has by now established itself very firmly within the geographic discipline. There are special courses taught at University level, specialised periodicals are devoted to this discipline. One can mention here *Population Geography* published in India, another quarterly under the same title appearing in England and, another periodical – bilingual *Space, populations, societies* published in France. Newer monographs are also available on the market (Noin and Thumerelle 1995). Concern with population distribution continues (Noin 1997).

However, the constant evolution of science, as well as that of society at large, brings new problems and challenges which influence the mutual relationships between the disciplines. The increasing interest of demographers in migration and the emergence of regional demography has undermined the nearly monopolistic position enjoyed by geographers. On the other hand, in mega-research and in spatial planning there is a need for people who can synthesize special contributions by narrowly trained experts. This in turn may bring about another change in paradigm with geographers, once again trying to broaden their training and research activities to the detriment of topical disciplines. As Adalberto Vallegra put it in a recent article *"The conventional geographical approach has been essentially sectoral… At the present time, the perspective of integrating these three fields* (physical, social and cultural geography, L.K.) *in a view of refreshing the approach to spatial diversification is taking shape. It is being supported by a twofold justification: a scientific one, because there is the need to make geographic research increas-*

ingly effective; a social one, because there is the need to provide holistic views of place and spaces" (2000, p. 50).

While the academic structures favour disciplinary training and careers follow departmental/ disciplinary lines, the research requirements call for an interdisciplinary or multidisciplinary approach. Demographers and geographers meet in addressing problems either within major research programmes such as those created by UN agencies or international non-government bodies, or within planning institutions while addressing short-term problems facing regions, cities or localities. Each brings his/her own skill and approach and these may sometimes overlap. Sharp distinctions between disciplines are increasingly difficult but the need for disciplinary training, especially at an early stage of professional developments, is still present. The strong presence of geographers within the demographic professional associations shows a desire to cooperate which is likely to continue into the future.

In the meantime, geographers are making their own contribution to the broadly defined research field whether developing new research tools, like *Geographic Information System* (GIS), or by active participation or leadership in major programmes such as *International Programme on Human Dimensions of Global Environmental Change* (IHDP) or *Man and the Biosphere* (MAB) sponsored respectively by the *International Social Science Council* (ISSC) jointly with the *International Council on Science* (IHDP), and UNESCO (MAB).

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