

## **Pál Koudela: Fertility and Evolution. Changes in Reproductional Strategies in the Information Age**

### **Abstract**

The first demographic transition can be interpreted as a change in reproduction strategies. Under bad conditions the safest way for humans to ensure their offspring is to increase their number; under good conditions it is easier to have fewer offspring with more parental investment. The further decreasing of fertility in the second demographic transition can be explained by the reduction of the size of the primary group. In the first and longest period of human evolution, the separated, face-to-face groups were typical. In such a competitive situation the pressure for under selection loyalty became a very adaptive feature. From the evolving societies original groups eroded. Tribes became clans, clans became extended families and later nuclear families. Now the final group size is the one-person group. People help their group to be successful when they have a career, and they give up their personal interests when not having children.

### **Key words**

- Evolution
- Demographic transition
- Fertility
- Sociobiology

### **Fertility and Evolution**

Demographers have given a lot of attention to the question: why and how the two fundamental components of the population - fertility and mortality - changed in the last two centuries. Global models entered scientific thinking under the name of demographic transitions and many new thoughts were born to explain these transitions. In the following we would like to add to the explanations already given on the basis of evolutionary theory.

#### **The first demographic transition**

During the last two centuries one of the most important events was a series of changes in strategies of reproduction. Until the beginning of the 19<sup>th</sup> century high birthrates and high mortality were typical of every society of the world even with the significant differences between them. (Maddison, 2001) The tendency for mortality rates to go down first appeared in England before the industrial revolution, and it accelerated in the 1840's. The reduction in infant mortality was not immediately followed by a reduced production - a good example for an exception is Hungary - therefore this resulted in the beginning of a huge growth of population which was halted by a reduction of fertility, stabilizing the relationship between population and environment.

These series of changes in population have come about everywhere at various times and at a different rate. This phenomenon was of course noticed by the social scientist of the time, but it was not until 1929 that the first scientific theory was published and was given the name of demographic transition. (Thompson, 1929) For the causes of these modeled changes they first looked to economic factors: industrialization,

agricultural and technical development, urbanization, modernization, etc., and behind this reasoning stood the Malthusian theory. Actual historical research, the study of regional and societal strata soon showed that we cannot find such universal explanations in either economic or societal development. (Demény, 1968; Coale ed., 1976) The search for an economic explanation brought with it the study of the financial status of various groups in society, which brought us closer to the microstructures, but it was not until the last few decades that the question was asked how and why individual people had changed their reproductive strategies.

After all the global changes in reproductive strategies are based on the decisions of individuals. The delay in the biological approach to this topic is especially interesting, since in demography it is fundamentally important to consider a biological perspective. Ignoring evolutionary theory is also surprising since this question is central to Darwin's work.

### **Evolutionary theory's answer to the first demographic transition**

The basic question is: what causes a change in reproductive strategies that can be answered easily from an evolutionary viewpoint: the changes in the environment. Within natural surroundings it has been observed long ago that the species who live in an unpredictable and in an insecure environment, and those that can expect a high death rate among their newborn, try to solve their problem of reproduction by having a large number of offspring and low levels of parental investment; while for those species living in predictable and safe environments producing few offspring is coupled with higher levels of parental investment results in a safer strategy. Following this model scientists started to investigate the inner dynamics of species, and observed how individuals make constant decisions about the optimal distribution of their limited resources. (Borgerhoff Mulder, 1992) Because reproduction is costly as a result of natural selection the organisms have developed an ability that allows them to behave according to the different strategies of reproduction in order to maximize their inclusive fitness. The main idea therefore is that in the animal kingdom organisms distribute their energy between somatic vs. reproductive effort. It is possible to switch between the two strategies at any time considering the costs and expected benefits. All of these mainly depend on the mother's physical condition, resources and the risk of parasites. With a growing number of children there is a reduction of available energy so a short-term energy reduction allows for a long-term growth in progeny since this way there will be more energy left. In a stable environment without risks and with plenty of resources for many generations individuals produce few offspring because the survival and reproduction of these is predictably secure. In such a situation it is not advantageous to increase the number of offspring because this would only reduce the energy per capita, thereby reducing the chances of safe survival. In a high risk, low resource and high mortality environment, on the other hand, it is advantageous to increase the number of offspring, even if this results in a reduction of the viability of individual offspring, because this way the probability of the survival of at least a limited number of offspring and the success of reproduction can be increased. In an unpredictable environment the taking of risks is more permissible since the individuals only know the immediate costs and returns. Individuals learn the appropriate level of risk taking when they are young and this forms their behavior patterns. For example stress in childhood can be linked to

preferences in adulthood, sexual behavior: the timing of sexual life and the number of partners. (Chisholm, 1999) Local conditions of mortality decide individual strategies. Under good survival conditions the mother can allow herself to invest highly in her children increasing their ability to compete. Under bad conditions low cost childrearing of many children increases chances of survival in good years and reduces the losses in bad years. That is, where there are low levels of mortality, according to a long term strategy it is optimal to have fewer, healthier, more capable offspring with higher level of investment, because the individual can thus maximize the number of offspring with guaranteed high reproductive abilities for future generations. Even in industrialized societies it can be assumed that people have chosen similar strategies: basing the chances of survival of their own offspring on their experiences of mortality rates in their immediate surroundings, and - even if not consciously - these experiences influenced their decisions regarding the numbers of their children and the times of their births. (Wilson and Daily, 1997) A similar observation has also been made investigating current subcultures. (Berezkei et. al., 2000)

Therefore the reduction in mortality can be interpreted for the individual as a change in the environment so individual decisions have to be understood in the light of this: the environment has become more predictable which results in lower fertility, i.e. lower number of children and higher parental investment. The changes known as the first demographic transition therefore were not a result of the idea of the optimum number of children in people's minds, they were not behaving according to some conscious plan when reacting to a lower mortality where they decided to have fewer children, but they reacted to the safer environment by changing their reproductive strategies. It is not accidental that it was also around this time that the relationship of parents to their children has changed, which can be understood as an increase in parental investment. According to Aries the parental attitude of the Middle Ages of keeping a distance and relative indifference were due to the high level of infant mortality. (Aries, 1962) This does not contradict the human species' specific feature: among various species a high level of parental investment which automatically follows from the long childrearing period (Pollock, 1983), and Aries's exaggerated negative opinion is in reality only a projection of current perceptions on children. (Sharar, 1992)

The population explosion resulting from the first demographic transition is only a "force of momentum", the result of the slow adaptation to the changes in the environment. How slow this was, of course, was influenced by the circumstances. The explanation of the demographic transition is therefore obvious. The reduction in the number of children is not a maladaptive behavior, but an adaptive strategy to the environment. (Lam, 2003)

Even fertility, influenced by Quality-Quantity progeny, seems to be a maladaptive behavior in a Darwinian sense. In Lam's opinion this in particular is very interesting in population dynamics: in modern circumstances fewer offspring pays in the more numbered offspring of the grandchildren's generation. But the parents' behavior is not surprising when they increase their investment in order to increase the quality of progeny, and to get higher status in allocating resources. They do all of these just to ensure the existence and survival of descendants in bad conditions. This way even an investment in quality repays itself in quantity in the next generation. In this sense there is not such a big difference between prehistoric and historic ages as it

was supposed.

### **The second demographic transition**

All of this is a somewhat compact explanation: the changed environment induced a new reproductive strategy, which, according to the closing stages of the model, guaranteed reproduction in a stable manner. At the same time changes did not stop with the information age; the fertility rates per female fell below the 2.1 reproductive level in the U.S and in Western Europe everywhere (Van de Kaa, 1987), and Eastern and Central Europe followed the changes at the end of the century. In Great Britain e.g. the total fertility rate between 1970 and 2000 fell from 2.43 to 1.65, but even in the U.S., which was often used as a counter example (Drucker, 2001), fell from 2.44 to 2.06 in the same period. According to Van de Kaa's explanation the dramatic fall of norms plays the main role, and he named this process the second demographic transition. (Van de Kaa, 1989) The demographic changes in the second half of the 20<sup>th</sup> century, on the other hand, are made up of many other factors. During this period the number of marriages was radically reduced, the date of marriages was postponed and the number of extramarital births grew enormously. In the U.S. only, in 2000 the ratio of extramarital births was 33.2%. From the 60's onwards the divorce rate began to increase.

During the 20<sup>th</sup> century the chances of survival kept increasing: life expectancy at birth went up and mortality and morbidity went down. Due to the low levels of fertility and low mortality rates the age-structure of the societies concerned changed radically: the number of the elderly grew to previously unknown proportions. The result of the continually developing - and for this demographic era greatly significant - medical science meant not only the growth of life expectancy, but also the growth in quality of life for the elderly. How long we live is no longer the only important thing, but also how well we live: this latter development is sometimes called the third demographic transition.

There are many factors behind these changes and it is also impossible to estimate the number and rate of implied economic changes. The reduction in the rate of marriages and the postponement of its dates has brought into doubt a marriage's function of founding a family: instead of the traditional integrative function of the family, cohabitation became more prominent. The previously central role of children was pushed to the background, in everyday life - in particular because of the lack of the family's integrative force - the continual strengthening of one to one relationships came to the front. It was not only in a statistical and legal sense that the family unit started to disappear, but the quality of relationships changed. Partly as a result of the emancipation of women, partly because of their rising employment and social status (Joshi, 2002), and partly because of the possibility of consciously choosing their number of children, for those living in relationships self-actualization became the most important. The family's role of socialization in forming society started to decrease. Whereas before values, norms and behavioral patterns were passed down through the family, now these have to be picked up from various different areas of life. These areas are driven by business and other interests, and they differ from each other both culturally and by location, and thus the child's developing system of norms is neither coherent nor stable which makes finding their way in society and maintaining relationships with others much more difficult. As a consequence of divorce children's emotional development also suffers. In the 60's the percentage of families with more children among the

dissolved marriages was 40%, while today this proportion exceeds 70%. It is almost impossible to give even a global picture of those economic changes, which were the result of demographic changes, for example how the consequences of aging societies on the proportions of providers vs. dependants influenced economic productivity or pension system etc.

The first models of explanation developed from the classical economic framework embedded in the mechanisms of markets with cost benefit analysis. (Becker, 1960) With the spread of a sociological approach the explanation for demographic changes were extended by cultural, religious (McQuillan, 2004) and other viewpoints. (Bongarts - Maudlin - Philips, 1990) At the same time arose a need for long-term explanations as well, since the simple model of demographic transition cannot adequately explain the last fifty years demographic events. (Calldwell, 2004) One of such frameworks of explanation for long-term changes is the evolutionary theory, whose representatives give the following explanation for this process.

### **The second demographic transition as explained by the evolutionary theory**

Man's change in reproductive behavior during the 18<sup>th</sup> and 19<sup>th</sup> centuries in Western Europe gave rise to preferences aiding low fertility. People, adapting to their changed environment chose as their fundamental norm the raising of fewer children. At the same time people's behavior - and so their behavior relating to reproduction - is mostly governed by cultural factors whose spread is also particular. The control over mortality and fertility is greater then at any time before in man's history. The influence of the external environment and of biological factors has gone down; demographical decisions are made by couples. (Robinson, 2003) The norms controlling behavior are spread by the aid of the cultural transmitting mechanism of learning, thus they form part of an autonomic organizational level, which has its own evolution and its coevolution with the biological level. (Lumsden and Wilson, 1981) Man is fundamentally a cultural being and so cultural influences can override biological factors and this is exactly what happened in this case. The particular cultural transmitting mechanism spread with incredible speed those cultural norms, which developed mostly through biological influence, i.e. the preference for low numbers of children.

This kind of explanation claims to include an investigation of the biological factors and the environments demographic determinants, economic compromises, personal tastes, preferences, sexual roles, self-interests and cultural interests, social security, and a safe future through their interactions with each other. It draws a parallel between behavioral ecology and the frameworks of life history theory, thereby uncovering the genetic and neurological substructures behind behaviors of fertility which are responsible for today's conscious decisions and which are the result of previously unheard of low fertility. (Hobcroft, 2003) Therefore, the answer to the question of how fertility could have fallen below the reproductive level is hidden in the common evolution of culture and biology. Biological evolution preformed human behavior in such a way as to maximize the number of descendants with the aid of sexuality. Sexual gratification on the other hand was separated from childbearing by contraception, thereby reducing the role of this biological function. At the same time evolution developed numerous inner drives towards personal relationships, towards feeding and parental responsibility, which was originally an adaptive behavior for the survival of the

offspring. These characteristics continue to urge people towards bearing children, while the cultural norms primarily influencing behavior exert an opposite effect. As a final conclusion this explanation makes its central point the norms and their changes described by Van de Kaa.

### **The second demographic transition and the one person group**

There are some difficulties with the explanation previously sketched. It is hard to decide when the biological or when the cultural determination is stronger, and why. The most difficult question to answer is: how could a behavioral form spread and stay present - even in a cultural way - which is maladaptive for individuals. In the model of the first demographic transition the lowered fertility was only a change in reproduction strategy, which led to stable reproduction in a predictable environment. This would have been the case, if the reduction of the fertility had stopped about one century ago. The behavior which led to a low number of children was adaptive while guaranteed a replacement population, but as soon as it fell below the minimum reproductive level it became maladaptive and so in one way or another it should have been selected against, or at least it should have shown signs of this.

In the following we intend to show a possible explanation to this dilemma from the evolutionary standpoint. The coevolutionary theories themselves have an explanatory power under societal conditions that were typical of the early parts of human history. These were the times when due to low population levels people lived in relatively small and separate groups. These groups were closed and had a tight group structure and in opposition to groups of animals they had high construction abilities and high levels of cooperation. With the development of language, with the aid of second and third level representations they built a cultural environment where the direction of genetic changes was taken over by the selection pressure of society. (Donald, 1991) A considerable part of human species-specific features which are still characteristic of humans today, developed in this period. These were, for example, the lowering of in-group aggression, the solving of sexual rivalry with the help of monogamy and the loyalty to the group. This last one was based on the following conditions: the development of cognitive abilities of humans and the possibility to imagine the group as an abstraction. These features and human constructional abilities, synchronizing abilities, gift for languages and abstractions - as a scene of changing representations - together lead to hasten the cultural evolution. Control systems, norms, languages - which were typical of certain groups - were developed with the aid of all these factors. These features started to evolve fast and in different ways because of the socializing ability of humans. Collective beliefs and religions evolved, and collective group plans, actions and constructions were directed by these common thoughts. Xenophobia grew hand in hand with the loyalty to the group, and later - after the sizes of the groups had grown and the amount of the available land had diminished - the inclination to negotiate between groups gained prominence, which further lowered aggression. Humans were adapted to life in such groups. Socialization is perfect and builds up a harmonious personality even today, when the child grows up in a world without doubts, when he does not need to consider the difference between good and bad, and is not responsible personally for decisions.

In modern mass societies written laws and other rules had taken the place of directing the ideas of the groups. Because of the differentiation of these rules religious groups, schools, political parties etc. exist

parallel to each other, building on the elementary strength of people's inclination to be part of a group. Natural groups reduced fast under such conditions: tribes became clans, then families and then nuclear families. Man living in today's world is however proud of his personal autonomy. Living in groups in the past did not give people a chance for a private life (in a contemporary sense). According to current viewpoints about managing our lives - making clever compromises, actualizing yourself etc. - loyalty and faith hardly play a role. It is precisely this, that stands behind the instability of relationships and the consequence: a high divorce rate. Negotiations between groups are characterized by these patterns. The ultimate group size becomes the autonomous personality, who is forced to organize his own actions, choose the components of his own beliefs and convictions himself. We look for many pseudo solutions instead of the lost socialization as a consequence of the disintegration of family, for example in the media which gives us a spectrum of desired values and a feeling of connecting to a group for example in a soap. That is, the fundamental need to connect to a group lives on in man, and he indulges this desire in the most extreme ways. (Csányi, 2002)

Therefore man's ability to learn social roles and his need to satisfy this did not diminish in the one-person group, only the small groups of the past were replaced by the various social sources. With the loss of the family unit we miss its function as a place of primary socialization, even though there have appeared several secondary and tertiary fields of socialization (school, work place, friends), which are replacing the family's socializing role to an ever-greater extent. While in small closed groups the individual's behavior was determined hundred percent by the ruling ideas of groups, the development of the one-person group is influenced by ideas he encounters and these become his models. While in an archaic group the individuals' habits for choosing clothes could at most change by a change of generations, the most apparent thing about fashion today is that it changes extremely rapidly. Archaic man followed the models of his group and in his environment today he is still looking for reference groups whose models he can follow.

This is one reason why fertility became so low, because the spread of influential idea was very fast. However the idea was not an order to "have few children!", as the above mentioned theories of evolution supposed. During the cultural evolution the control of the individuals' most basic behavioral patterns were taken over by ideas. As we mentioned before this does not mean that man's biological urges have disappeared, simply that his socialization as a species-specific feature overrode his individual interest. In the historical period of group competition the individual's interest in the survival of the group rose to higher levels than ever before. This is still strongly typical of man even if the group in its historical sense no longer exists. This is the real reason why fertility went down. Simply an idea became dominant and spread "fashion like", very fast, and this idea was the order to put group interests first. The individual's biological reproductive inclination, his motivation for genetic survival did not disappear, only it was smothered by another "interest". Research on willingness to bear children reflects all of this precisely when we get the following answers as typical. According to such research even those individuals or couples who do not wish to have children mostly state or acknowledge that children are a good thing and they would also like to have children only "they cannot afford it" or "their career is more important". The definitions of career or of

individual survival however differ from the previously mentioned usual definitions.

Even in the animal kingdom we can observe the dilemma or chance for decision where the individual has to decide between his own and his offspring's chances of survival. If he has a long reproductive life ahead of him his own life will become more important as he still has a chance to pass on his genes. If not, the scales will tip in favor of his children, and raising the level of parental investment will best support the continuity of his genetic line. In the case of one-person groups this dilemma has changed completely. The individual's idea of a career, of self actualization, of his being successful in life, are characteristic of competition between groups, which in this case mean one person groups. The human speciality: a loyalty to the success of and the defense of the group, come from the evolution based on small groups' competition in the past, and appears in modern mass society like the following. The survival of the group (the person) is more important than that of the individual. Considering that genetic diversity was low in groups based on familiarity the individual's "genetic value" did not suffer. Today the individual's career is the same as group survival and reproduction sacrificed in exchange is equivalent to self sacrifice for the interest of the group. Those responding in surveys are accurate in articulating their biological preferences when they state that they would like children, the ideal and the planned children express this. Their group loyalty is also accurately expressed when based on their individual expectations they give up on having children. The actual and complete number of children expresses this, which is usually much lower than the previous two indicators. In this sense even the individuals' reproductive intentions were overridden by the cultural evolution in such a mega population as the western civilization. At the same time in the third world such a process of globalization has not even started or was about to start. In today's western society it was precisely for this reason that the numbers of childless couples and couples with only one child grew. This latter one has two characteristics. One of these is that this is the next step in a process, as the development of the two child family model is the result of the reduction of the number of children, which was subject to the workability of the nuclear family model. The relationships that were still stable in the nuclear family phase have loosened by now, the family's "sacred" ability to form a group as an idea is disappearing. The change in expectations of those embarking on the rugged journey of a marriage is also behind the growth in divorce rates. Today the individual's self-actualization and self-interest stand above the importance of self-sacrifice. Those entering into a marriage and deciding to have only one child - for similar reasons - are reducing their individual risks by having a low number of children: left alone it is still possible to raise one child without giving up one's career (Joshi, 2002), i.e. the "group interest"; on the other hand two would be difficult. This is therefore the result of the multifunctionality of the one-person group, and tied together with this is the fact that the ratio of families with three or more children has not changed significantly. This is because in these relationships traditional values, the value of the relationship or family as a community (group) is the governing premise, and therefore in today's society we can call this a subcultural phenomenon. The diverging distribution of numbers of children shows well this process, its development and the segregation of this subculture. At the same time the individual's desire to belong to a group still remains even under these circumstances. Although their willingness to bear children was pushed behind the interests of the one-



person group, their altruistic behavior again and again finds a suitable group to flourish in. This is how the loyalty to one's company developed, the extreme example of which was Japan in the last fifty years, and which became the norm for behavior in the western world of management.

### Summary

It was the explosion of the population, which made it possible for the small group as an organizational unit to disappear and for the second demographic transition to happen, but it was not the reduction in fertility in the first transition that directly caused further reduction in the second transition. There is no simple trend in the continued lowering of fertility rates. Both the first and second instances of reduction are a reaction to a change in the environment, but in each case there is a different change, and there is also a difference in the biological factors involved in the changes.

Naturally, in the framework of this theory countless important questions could and should be answered. As long as we accept the premise that the development of the individual happens in the community (Bruner, 1990), then it follows that with the disappearance of traditional communities the mode and circumstances of the development of the individual will change. We can gain a very particular approach to the development of imagined communities (Anderson, 1983), if we take into account the age-old need to belong to a community. But such revealing questions like these would belong to a further research.

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