

HUMAN ECOLOGY BY THE END OF 20TH CENTURY. PERSPECTIVES AND TRENDS FOR THE FUTURE OF HUMANKIND

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PART I. PROBLEMS OF HUMAN ECOLOGY

A human being lives in several concentric envelope layers. The first one, which is closest and protects him (if we ignore clothing) against the external world (sometimes friendly, sometimes risky) is a household. The second one is a settlement —physical and social environment around his family. The third-order layer is a geographic and climatic region with its wildlife —characteristic of a given settlement and its surroundings. Outside this third layer there is our global world, located somewhere in the cosmic space universe.

Each layer (envelope) is a kind of a filter which selects, segregates, and controls part of the environment external to this layer, which is recognized at this moment as a center. Properties of these layers can be measured physically.

1. Man and his environment

If we consider the man as a center, the surroundings will comprise everything around him, and the environment will represent all with which he is related. In this sense a niche is the environment. The niche is not a geographic place, and not only a place of physical localization and

contacts. The niche in relation to human beings is their localization in «the matters of this world», including their biological, social, and cultural links.

Obviously, the totality of the elements of the surroundings forms the world in which we live, but not all of them directly concern a given man. The environment is a kind of synthesis of the surroundings, a result of interactions among its components. The niche of man can be understood as a settlement and a house, which provide his physical environment (abiotic, biotic, and man-made), and a local society and family, which represent a socio/cultural environment (other people and nonmaterial, spiritual culture: ideology, religion, ethnic traditions, cultural customs, etc.).

Is this sense, the human settlement is a niche of the population, and the household and its interrelations with the settlement and society is a niche of individual human beings. But interactions of individual humans with both organization of the society and infrastructure of the settlement give rise to a network of overlapping bonds.

From the viewpoint of human ecology as «a synthesis of knowledge about human life and culture as dynamic components of ecosystems», three aspects are important in relationships between organisms and their environment (Table 1): 1) characters of human beings and population, 2) characters of the external environment, and 3) biological and socio-cultural responsiveness (reactivity), of individual human beings to environmental conditions (abiotic, social, and technical). This responsiveness is in a sense their inner environment.

A. Differences in heritability in various populations

Genetic information transfer from parents to their progeny is steady, and on average half of the genes of each parent is transferred to the progeny/descendants. Thus, the correlation coefficient of resemblance should be equal to 0.5. However, this is rarely the case. The resemblance increases with age, which is understandable in a sense if we consider a real similarity e.g. in body size, but even the resemblance of adult individuals to their parents when they were at a similar age is highly differentiated.

The ratio of the genetic to non-genetic component of the similarity of children to parents is called heritability. Heritability diffe-

Table 1
The main problems of human ecology

• *Factors of external environment*

A. Physico-chemical and biological

- climate and altitude
- nutrition
- living conditions (incl. housing)

B. Social and socio-economic

- society and environment
- environment of working place
- family as environment

• *Reactivity of organism*

A. Ecosensitivity (neuro-hormonal susceptibility)

B. Adaptability (physiological adaptive capacity)

C. Physical and mental activity

• *Adaptive changes*

A. Organismal level (phenotypic changes)

- Regulatory adjustments (short term reaction)
- Acclimatory adjustments (habituation)
- Developmental adjustments (plastic changes)

B. Population level (changes of gene pool)

- Differential fertility (positive selection)
- Differential mortality (negative selection)
- Mutations and genetic drift

C. Adaptational behavior

- Migrations (gene flow)
 - Socio-cultural adaptation
 - Transformation of environment
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rentiation is caused by non-genetic factors of human development. The genetic component is always the same, except for sensitivity to environmental factors which varies. Eco-sensitivity and adaptability are under genetic control, and they are modified by the experience of organisms from earlier periods of ontogeny. In a sense, sensitivity is related with phylogeny, as it also comprises evolutionary developed non-conditioned reflexes.

B. Reactivity of organisms: ecosensitivity and adaptability

Physiological (neuro-hormonal) and psychical (emotional and intellectual) susceptibility are crucial to understanding the response of organisms to environmental factors. Some individuals can show a very strong response while others a weak response to stress of the same kind and intensity, and particularly resistant individuals can show no response at all.

This sensitivity concerns the perception of the stimulus (stressor) at the entrance which provokes resistant and immune reactions, but the possibilities of its transmission and transformation of stimulus in the organism are also differentiated. Both these components have an effect on adaptational changes to a new situation caused by this external factor in the organism-environment system. This «input-sensitivity» is called ecosensitivity, and the «inner-sensitivity» is called adaptive capacity or adaptability (Figure 1). In general, a higher ecosensitivity is typical of females, and a higher adaptive capacity is typical of males. In effect, we observe greater adaptive phenotypic changes in males.

C. Sources of variation

What are the sources of an organism's variation? In addition to the inherited constitutional differences related to genotype, other sources of variation affect organisms over their genetically controlled ontogenetic development (Table 2). They include paragenetic factors (the effect on the fetus of the half of the mother's gene pool not transmitted to it—the so called genetic resonance of the fetus) and metabolic attributes of the mother (intrinsic conditions) related to her age, number of previous pregnancies, etc. They also include external (exogenous) factors. Other sources of variation are the

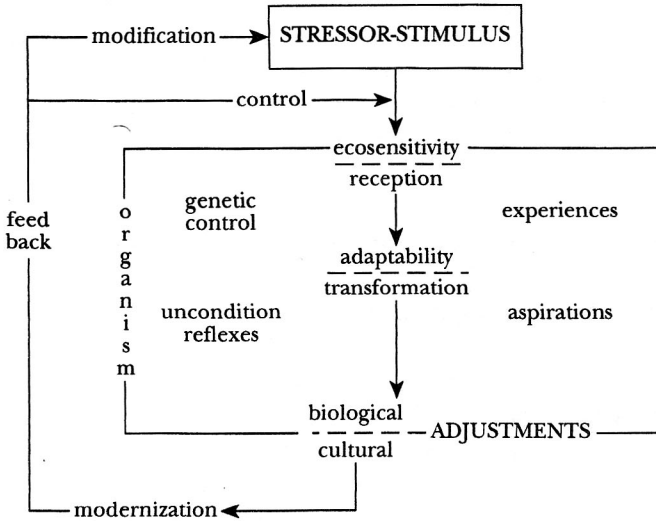
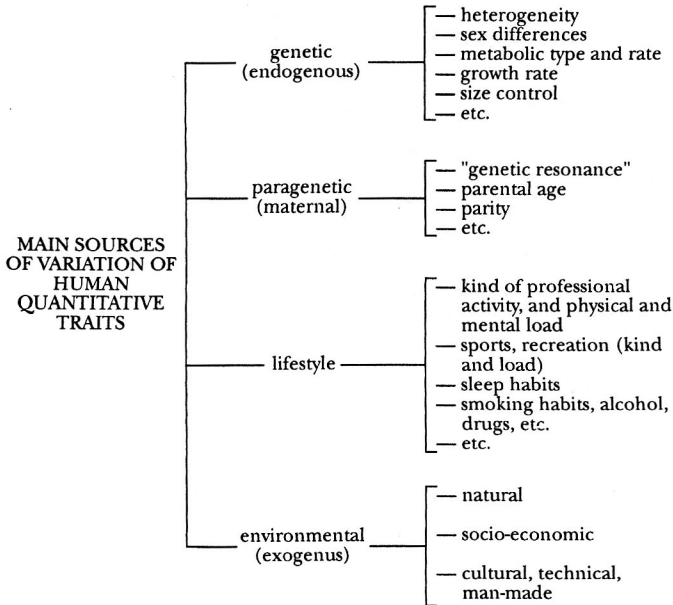


Figure 1. Model of ecosensitivity and adaptability of organism to environmental stimuli (stressors).

Table 2
Four main factors of human development



lifestyle, dependence on emotions, traditions, aspirations, and necessities of life. The final shape of the organism will be a product of complex effects of interrelated exogenous and endogenous factors, in proportions difficult to predict, rather than single factors.

2. The forms of adaptation to the environment in human populations

A. Organismal level (bioadjustments)

Adaptive changes in organisms are the main reason for their adequacy to the environment. There are physiological adjustments of an organism to existing conditions, and they can be called bio-adjustments. Survival requires adjustments of individual organisms. The first reaction of an organism is a regulatory adjustment so as to wait until variable environmental conditions or a stressor are over (e.g., excretion of adrenaline in the case of stress, dilatation of blood vessels, acceleration of respiration) and then to resume the earlier state (Figure 2). When these reactions fail, then longer changes, reversible in time, take place (acclimatory adjustments such as an increase in the hemoglobin level at higher altitudes, an increase in the adipose cell mass in the case of overnutrition, or work hypertrophy of muscles as an effect of work load). If these reactions also turn out to be insufficient to the functioning of an organism under given conditions, structural changes will follow (developmental adjustments —typical changes occurring with age, slightly different in individuals living under different environmental conditions, with different food habits, different physical strains, etc.). These changes cannot be reversed in ontogenesis but they are not heritable, thus they do not affect phylogenesis.

B. Genetic adaptations at the population level and their evolutionary consequences

Differentiated fertility (positive selection) and differentiated mortality (negative selection) are the basic forms of adaptation in lower organisms, but they also occur in higher organisms and, as a matter of fact, at least in early hominids. In this way, gene pools conferring

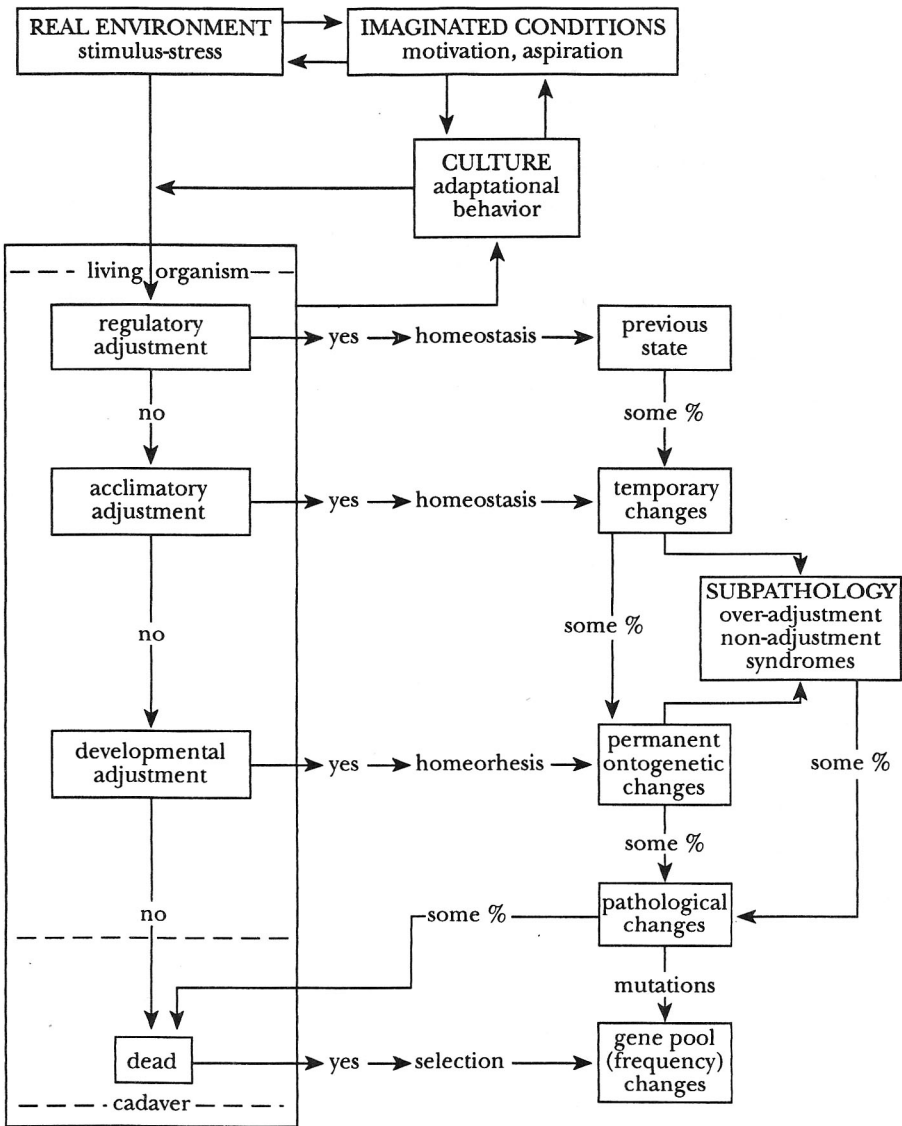


Figure 2. Model of adaptational changes of the organism as effect of environmental stress (bioadjustments).

adaptation to the environment extend their existence, whereas those not adapted to a given environment die before the period of reproduction (Figure 3). It is a controversial matter whether these mechanisms, especially negative selection, operate in contemporary, civilized man in view of medical progress, social welfare, and so on (Wolanski and Henneberg 1990, Dziewiecki 1994). For a biological adaptive process, it is important to reach and survive over the reproductive period. For socio-cultural processes of adaptation, the whole life is important, as older people form an important part of our environment. It seems that contemporary man is subject only to

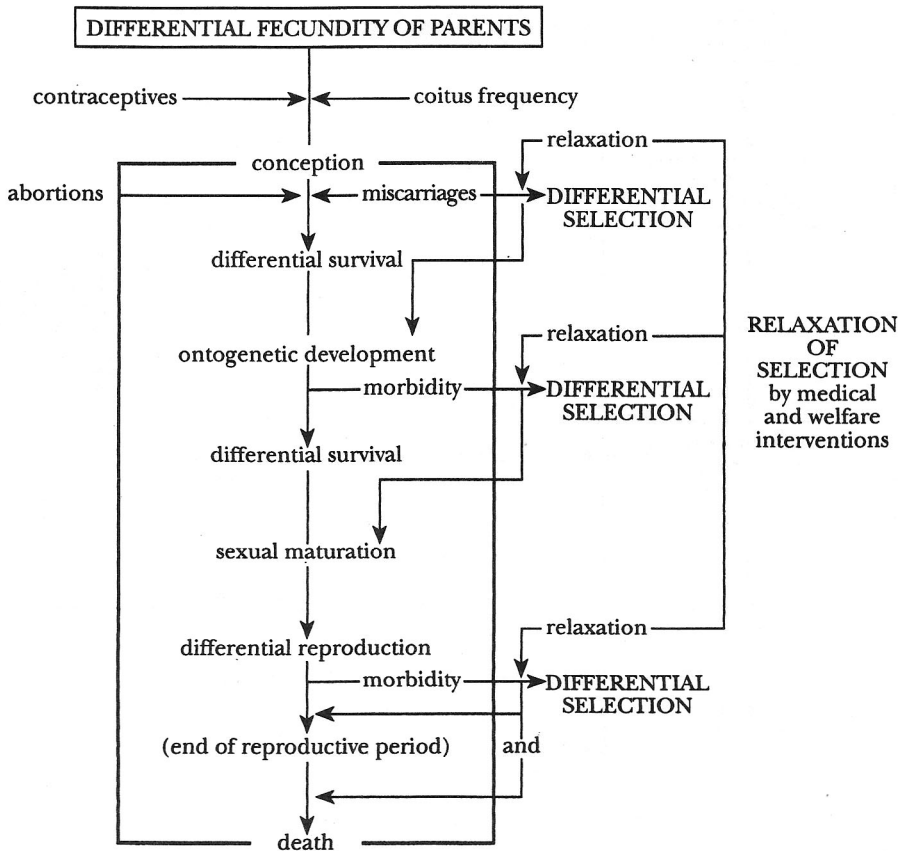


Figure 3. Genetic adaptation by differentiated fertility, mortality (selection) role of relaxation of selection.

stabilizing selection preventing the species from degeneration, but not to directional evolution.

C. Adaptive behavior (cultural adjustments)

Biological adaptive changes in man such as those described above are supplemented by adaptive and/or conservative behavior, related to socio-cultural habits (Figure 4), and/or migration, and/or transformation of the environment. Thus they rely on the modernization of behavior appropriate to environmental conditions, and/or on moving to another geographic area, and/or on the modernization of living conditions.

Essentially, they rely on changes in behavior, which typically occur in animals as well, but behavioral changes in the latter are unconscious, intuitive —they occur by chance or as unconditional reflexes perpetuated in the process of a long natural selection, or selection conducted by man. This kind of adaptation is thus considered as intermediate between biological adjustments and non-biological forms of adaptive changes. Adaptive behavior in man is a conscious activity towards a predicted goal: isolation from atmospheric influences, shaping of somatic, physiological, or personal properties, etc. In contemporary man this kind of behavior is related also to science and technology. These kinds of changes serve to avoid physiological changes, and especially morphological changes which for some reasons are considered as unfavorable (Figure 5).

Another kind of adaptive behavior is territorial change (migration) to a better place or to a place corresponding to the existing adaptations. In some tribes (e.g., in India or Peru), seasonal movements are observed, for example, to the mountains in summer and to the lowlands in winter. Another form of conservative behavior is modification of environmental factors occurring in a given place and time, instead of changing the organism itself or its personality, or migration to different areas.

Less than 10 thousand years ago (4 000 generations), nomadic groups settled because they started to cultivate the land, and over a life span of 300 generations, permanent human settlements developed. These settlements became the basis of urban civilization, lasting for about 100-150 generations. Genetic adaptations occurred through

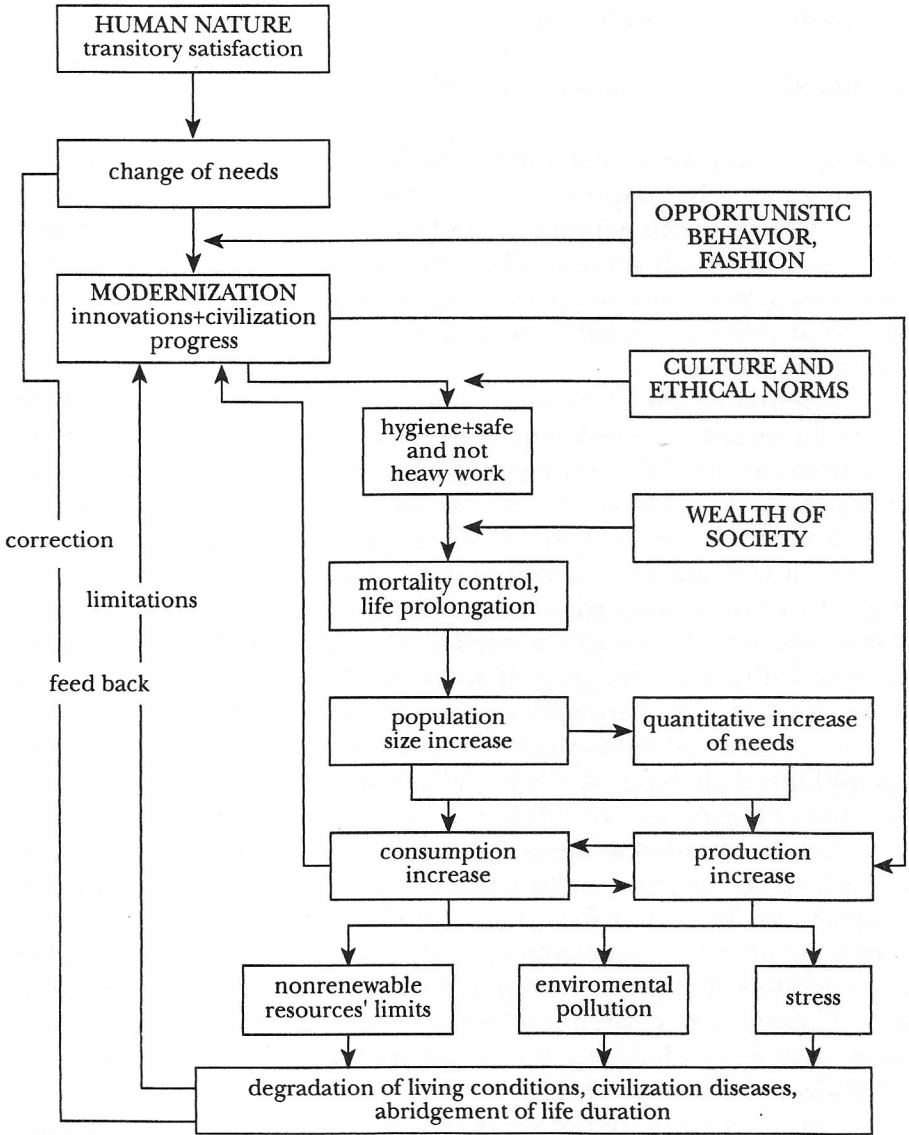


Figure 4. Model of adaptational behavior in form of modernization of contacts with environment or environmental conditions itself (cultadjustments).

changes between generations. Thus, a generation is the unit of biological evolution. The number of generations since the time of the colonization of cool regions and since the development of towns is too small for the evolution of biological adaptation to have occurred (Wolanski 1989).

Thus biological (genetic) adaptation has been replaced by cultural protection of the organism, in which adjustments became of secondary importance, relatively small and not inheritable. Such cultural protection can be called progressive from the perspective of time and environment.

Civilizations are typically defined as very advanced forms of social existence, based on written language, arts, beliefs (religions),

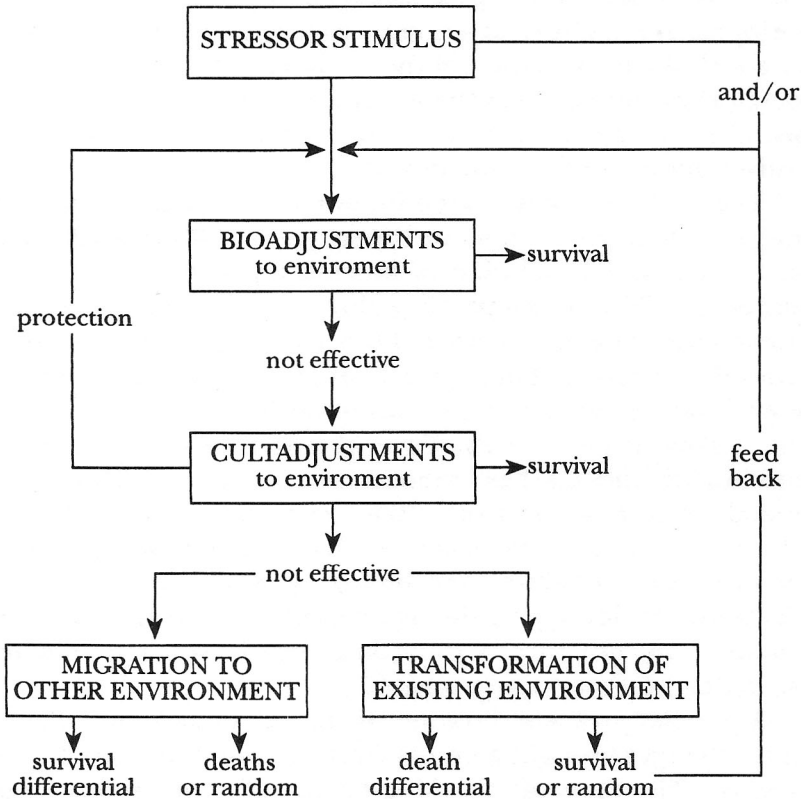


Figure 5. General model of adaptational changes.

and a relatively high level of technology. They are cultural expressions of a specific form of socio-political organization appropriate to the environment. Religion is an ideology of civilizations (an input), and culture is a practical (experimentally proven by generations) social way of life developed in specific environmental conditions existing in a given territory (an output). Civilizations emerged, developed, and died, like species in nature. Similarly, in nature some common attributes of life evolved and consolidated, also a universal trait of human cultural development, which nowadays predominates in all civilizations. A common property of life is the function of proteins (some authors define life as a spontaneous tendency to a permanent reduction of disorder or entropy). Similarly, a universal trait of mankind, developed in the process of evolution, is the development of culture as a non-biological form of satisfying needs along with the preservation of the common interest. The essence of biological existence lies in the struggle for existence between organisms, whereas the essence of the social existence of humans lies in altruism understood as humanness.

The evolution of mankind followed biological, social, and cultural pathways, presumably in this sequence. Many authors argue that the biological evolution of humans has ended (Wolanski and Henneberg 1990). It is a paradox that culture sustains (secondarily so to say) the «animal» nature of humans, as it protects the organism against the necessity of biological changes. Culture thus counteracts the evolution of human organisms towards the forms progressively more distant from animals. Thus, if it is true that the biological evolution of humans has stopped, this is due to culture. In the «animal» body a «creator of culture» evolves. Culture stabilizes the biological essence of human beings. That is, culture, which also undergoes evolution, inhabited the biological evolution of humans. In other words, in developing the psyche, culture petrified the some of humans. I am not sure if this contradiction will not lead to the destruction of *Homo sapiens sapiens*.

A parallel problem, however, is the extent and rate of environmental changes brought about by over 5 billion human brains living nowadays. The mass of «thinking tissue» of contemporary human beings is equal to the body mass of 100 million people living 3 thousand years ago (Wolanski 1989). Minds (brains) of those 5

billion people conceive ideas and transform the world, whereas their bodies require food, clothes, apartments, and more new products of civilization for a comfortable life.

3. Biogeographic background and civilization

A. Geographic, climatic, and biotic conditions (landscape ecology)

The environment on the global scale (in space) concerns the climate and altitude (atmosphere —especially the air). On a narrower scale it refers to geological conditions (waters and soils in particular), and on a still narrower scale to natural sources of food (nutrients), etc. Climate in the sense of a niche primarily refers to the local air composition, pressure, temperature, and movements. This geographical and climatic background of a region has an effect on the food produced and consumed (in the times of exchange goods or marketing, food may originate from different areas), on the composition of drinking water, and indirectly on the mode of life (e.g., through the kind of management: agriculture, mining, industry, etc.).

B. Demographic and economic conditions (socio/cultural system)

Access to, and even more so to the use of natural attributes of the region by man are socially limited. They primarily depend on the density of the population, demographic differentiation in terms of age and sex, births and deaths, and migrations, and, consequently, on socio-economic factors (economic activity, level of employment, family size, etc.), that is, on the possibility of obtaining food and other goods. Regional attributes are much narrower, and to some extent they may be understood as local, that is, typical of a certain human community. They influence the character of human settlements, and in part directly affect individual human beings.

C. Social & cultural characters of the country (political system)

Also within the same society, the access to natural and even more to man-made components of the environment is differentiated. It de-

depends on the social strata and on other social divisions, including the access to ruling and influencing the decisions of the authorities, thus the political system. The whole of these conditions forms what we call civilization (what was discussed before) with its ideological superstructure. These can be religions, ethnic traditions, and cultural practices, thus traditional behaviors. This kind of political system is typical of entire countries, but within them there exists a wide diversity of traditions, commands and prohibitions, cultural customs in different social strata, local societies (cities-villages), and/or professional lobbies.

D. Type and size of settlements (urban systems)

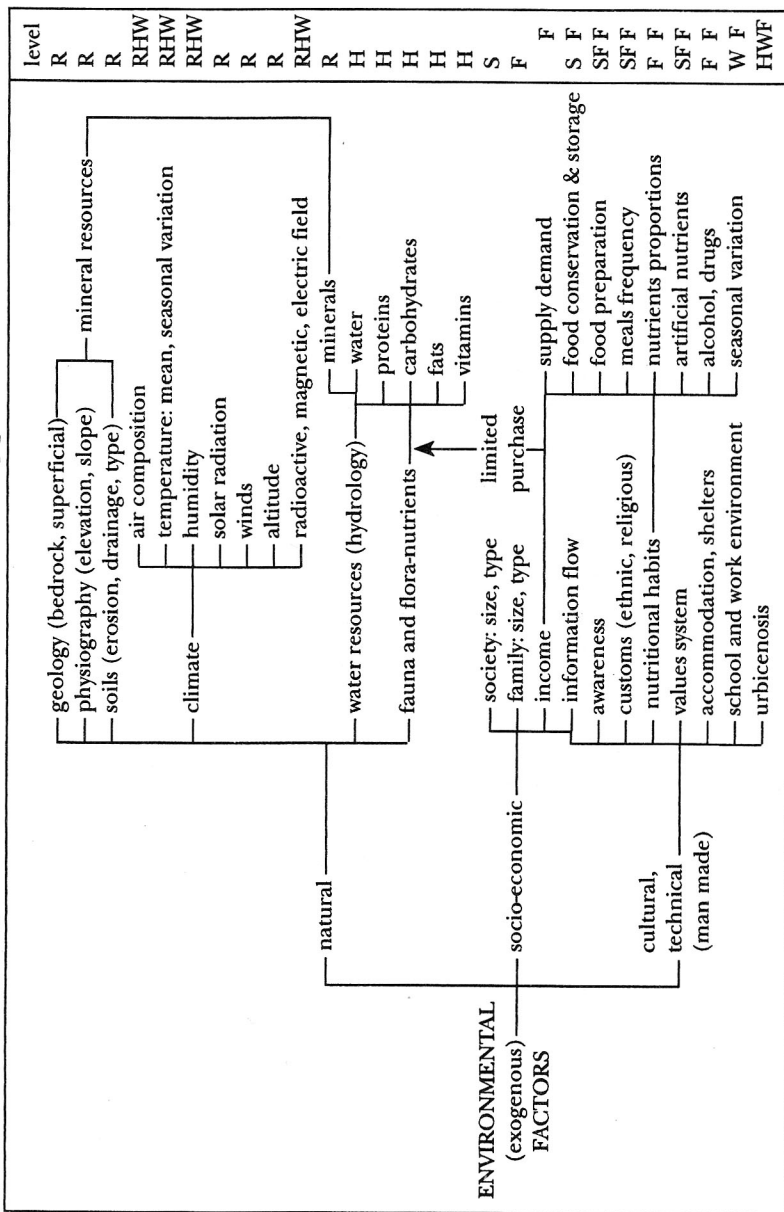
Human settlements are highly diversified, and in fact no two are identical. However, they also share some attributes, for example those used as the basis for their classification as towns and villages. This is also influenced by the development and character of industry, administrative functions, presence of cultural centers, and so on (Wolanski 1993). Differentiation also occurs within human settlements, depending, among other things, on the location with respect to the center of a given settlement in which the density of architectural structures and of the population per unit area is usually higher than in the peripheries, where in turn plants and animals are more abundant.

4. Regional influences (ecosystem and general living conditions)

There are three prime groups of environmental factors: natural, socio-economic, and cultural (technical, man-made). This classification is not obvious in view of the fact that social factors modify natural factors, and cultural factors have an effect on both social and natural factors. There are also many feedbacks. To perform a multifactor analysis of the effects of individual components of the environment, it is important, however, to enumerate them (Table 3). Factor analysis of all elementary properties of the environment can identify a few marker-traits providing the best description of a given environment as a complex of measurable characters. It is difficult to speak of a particular environment on a scale greater than a region or a landscape

Table 3

Elements of external environment (factor influence mainly on level of: R=region, H=home, S=society, F=family, W=working place).



in ecological sense. When analyzing environmental or ecological characters rather we mean local conditions of life.

5. Settlement as human environment

The settlement and the family modify the local and household environment. Infrastructures change the local climate: on the one hand, the atmosphere in towns is polluted with aerosols and dusts and the composition of drinking water is changed, but on the other hand, sanitary and living conditions are improved. In towns there is a division of labour according to qualifications. Towns were built to make people's lives easier and their environment more healthy.

Air temperature in the town is now by about 1 °C higher and more dry on average than the temperature of surrounding areas. Town waters frozen in lower temperatures, in old narrow streets is only 3% of sunshine penetration in relation to open space. Lighting on streets changes biorhythms even in animals living in towns. Architectonical structures and infrastructure influence physical and chemical components of the atmosphere. The town creates distinct conditions of hygiene: it modifies the world of microbes and shapes the fauna and flora, typically very poor, of our urban environment.

It is often claimed that the city is a certain type of landscape. This approach has recently been accepted not only by ecologists, but by sociologists as well. However, I believe that it is an understatement which will never be fully realized. As we said before, there are nearly as many types of city landscapes as there are cities.

The similarity between the city inhabitants is superficial. In fact, the differences between the inhabitants of individual villages correspond in some way to the differences between representatives of individual social strata in a city.

The internal differentiation of a city is also important. On the one hand, certain elements of city districts or individual cities, even when they are distant from each other, may be made similar, by the use of typical designs, the same prefabricated elements, types of construction, installations (including central heating system) etc. On the other hand, this does not usually produce identical results due to the influence of the surrounding region.

The city districts also differ in their social complexion. Once, districts reflected class divisions. However, to this day there are still differences between the physical development of children from villages and those living in cities, between children from non-manual worker families and from manual worker families. Usually these have been the result of economic differences, especially in terms of nourishment. Children from higher floors in buildings go outside the apartment (e.g. for active recreation) less frequently than those living in lower floors. A settlement as the environment not only has architectural structures and infrastructures acting in a physical way. There is also a beyond-physical environment evoking specific emotions and stresses. These strongly stressed aspects include: emotional stress in towns, connected with nervousness and the anonymity of life; increased noise inside buildings, and thus greater exposition to vibration, acoustic stress, and so forth. The complex of these new factors could be called industrial civilization syndrome (Wolanski 1993). An example of a complex of urban conditions may be the fact that young women reach maturity earlier in the town than in the village, even if the main factors regulating the rate of maturing (animal protein intake, parents' profession) are similar in the families compared in the two environments. Presumably, an accelerated stress factor is acting in towns.

6. Household as the environment

Although this is not unquestionable, it seems that the family is a social rather than biological unit. The state is a socio-cultural layer of the family, and the family is a socio-cultural layer of a human being. Family thus regulates natural relations between men and women and between successive generations. It is not necessary for producing progeny, as a temporary union of the opposite sexes is sufficient for this purpose. It is, however, necessary to raise and educate progeny. In humans this process takes about 20- 25% of the life span, thus it is very long. For this purpose, the family as the basic social unit is by all means beneficial. The family is a place of the development of the community of human beings, propagation of life and cultural traditions, maintenance of the biological (genetic) and cultural heritage,

participation in social development. Family laws are at the basis of the development of the laws of societies and nations.

Humans stay at home for about two-third of their time. This time is used for sleeping, meals, hygiene, home recreation, home work, and rest. Beyond home, sometimes in the district where we live, we spend nearly 30% of the time. This is especially the case of around the first 20 years of life when children go to the nursery, then to school, and play within the district, near home. Thus, home is primarily a physical environment of man. The settlement and school, typically close to home are in a secondary position during this period when the organism is developing. For adults, the place of work is an important environment.

We change our home environment and the style of our life, including the composition of the air, by using air-conditioning, buying furniture made of different chemicals, decorating rooms with wallpaper and tiles, or installing mechanical, electrical, and electronic devices. We individualize not only each apartment or a family house within a district, but also each room separately.

The essence of the family is a possibly faithful transmission of information to next generations: extension of the existence of the species due to reproduction, and extension of the existence of mankind in the form of nations and civilizations. But to keep pace with these conservative properties of the family, some trade-off with the surrounding life is needed. Thus, the transmission of information follows parallel, interrelated pathways (Figure 6).

To perform these two functions, a family must be psychophysically sound. The contemporary family is exposed to different pressures. They range from the external effects of the environment, independent of the family, through the effects of the man-made environment, which can be chosen, to pressures of social, ideological, and cultural institutions. As we already mentioned, they modify the genetically controlled ontogenetic development of man.

PART II. WHAT IS AND WHAT IS NOT HUMAN ECOLOGY

Human ecology is a synthetic transdisciplinary science about human life and culture as a dynamic component of ecosystems, based on

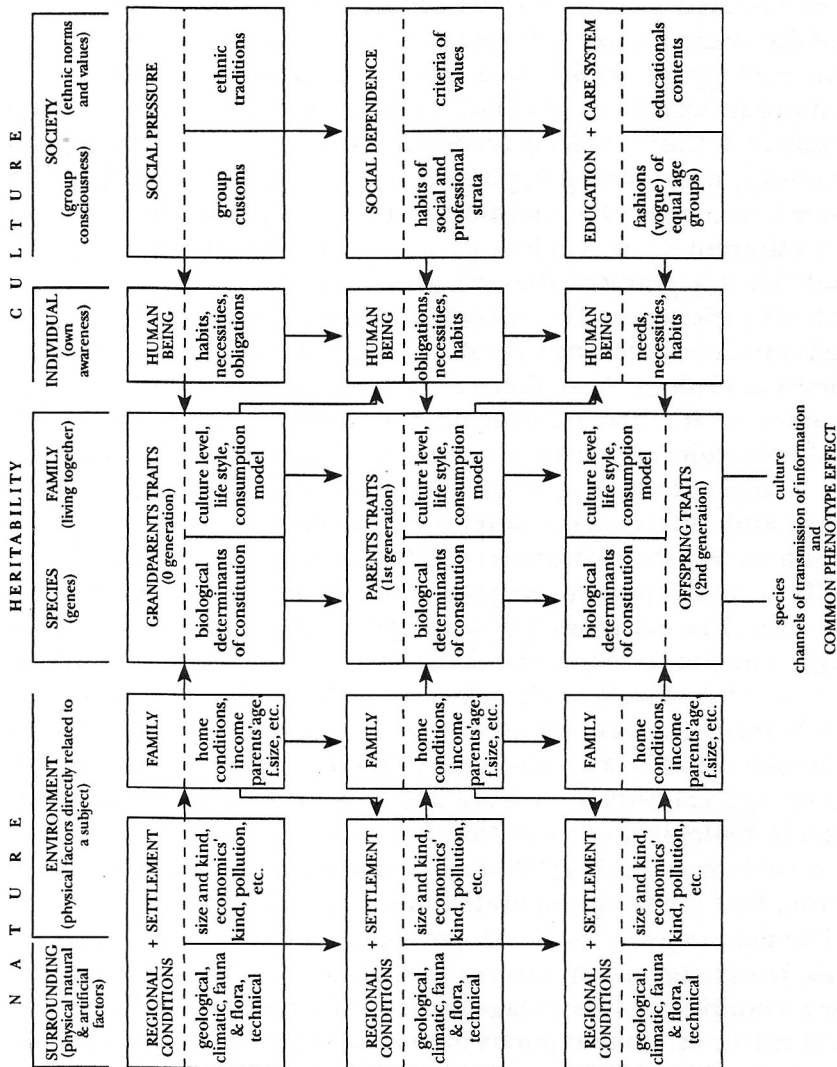


Figure 6. Model of interaction between biological (genes) and social (culture) channel of transmission of information between generations.

systems theory and cybernetics. However, from many possible directions of research about Man and his environment, not all is ecology, and only a few are human ecology. As I have written several times, all problems related to man and environment contain much more than 50% of the entire human knowledge. If we will call all this knowledge human ecology, it would be a science of almost all —and in a contemporary world this does not mean anything, because science is the study of definite subjects (classical disciplines like physics, geology, biology, anthropology), phenomena (like genetics, ecology) or problems. Human ecology is a definite transdisciplinary problem but with a different focus (points of view). Interdisciplinary sciences typically hold a point of view on problems that cross-cut classical branches of sciences. A branch called environmental biology exists, which is much broader than (bio)ecology, but it does not include all problems of ecology. Also, there are specializations and some directions of research called urban ecology, ecology of nutrition, environmental epidemiology, environmental health, etc. —which are only partly related to human ecology. It is important to understand these relations and differences in several examples.

Human ecology synthesizes specific knowledge from several disciplines: anthropology, geography, sociology, ethnology, etc. in a specific way. In a monodisciplinary stage, all these are called human ecology, but not as particular branches of science, but rather as directions of research or doctrines in individual, classic sciences. Probably this term was first used in geography (Huntington 1916), next in sociology (Park and Burgess 1921). In a sense we can say, that was geographical human ecology, sociological human ecology, etc. Related to biological sciences this direction is still called biological human ecology or ecology of Man. In anthropology this trend is so common, that it was not separated into a special branch.

The next stage in the development of human ecology collected all this knowledge from various disciplines (Wolanski 1991a). It became a multidisciplinary stage presenting a mosaic of information without synthesis. Contemporary human ecology is no longer a mosaic of knowledge, but rather it is a synthesis based on systems theory. Thus only the kind of research described above, that analyzes the human-environment relationship in which biological and cultural status of populations is a criterion, may be understood as human ecology:

Geography is not human ecology and human ecology is not geography; sociology is not human ecology and human ecology is not sociology, human ecology is not cultural anthropology nor ethnology, etc. But in geography or sociology it is a doctrine about the role of the environment in distribution or organization of people in space. This is a point of view in this particular discipline, at least a branch of this discipline, but does not imply interdisciplinary human ecology as a new branch of science per se. Geology, geography, biology, anthropology, sociology, ethnology are different scientific disciplines, most with their own (sometimes longer, sometimes shorter) histories as different branches of knowledge. Human ecology is a synthetic problem that cross-cuts the classical disciplines. Human ecology is an interdisciplinary field of knowledge which uses systems theory to analyze transformations of human populations related to environmental changes. This is a multidimensional focus from a definite point of view.

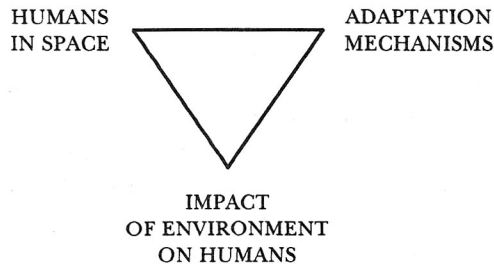
Demographic and ecological issues are now subjected to strong social and political pressure because of the consequences of the explosion of human populations and its relation to the above environmental deterioration (Wolanski 1991b). There are urgent practical problems. This pressure also influences the development of the synthetic science which is human ecology, as a basis for action-oriented human ecology as a socio-political movement.

The list of problems of human ecology in several sciences can be ordered into the following groups:

ADAPTATION MECHANISMS: Rules of adaptability [in ecology]. Human adaptability in ontogenesis (organismal level) and phylogenesis (population level) [in anthropology]. Environmental physiology [in physiology]. Adaptational cultural behavior, culture as niche [in ethnology]. Developmental adjustments [in auxology and gerontology]. Gene pool in human populations and environment; selection [in genetics].

ECOLOGICAL IMPACT ON HUMANS: Economic conditions and psychophysical status [in economics and politology]. Food and feeding and nutritional status [in bromatology]. Urban-industrialization impact on humans [in spatial planning]. Biological effects of demographic changes [in demography]. Ecology of health and diseases [in epidemiology].

HUMANS IN SPACE: Human belief related to nature [in philosophy]. Anthropogeography and bioclimatology [in geography, climatology]. Social spatial relationships [in sociology]. Anthropopressure and education to environment are on the border of interests of scientific human ecology and action-oriented human ecology (political and social movements). The above problems are related to 3 groups in the following fashion:



In research on human ecology two main kinds of relationships are important: (1) impact of environment on human beings and populations and adaptational changes in man, and (2) impact of man on the environment, called anthropopressure. Most studies of the second kind are objects of bioecology; human ecology studies the first kind of these relations. Environmental management and conservation is not a typical area of human ecology, but rather a part of applied ecology. But if there are no such activities in a country or an institution, it should be adopted into human ecology.

The entity of human ecology are interactions between humans, humans and other living organisms, and humans with environmental agents and forces as a whole. The object of study is not the unidirectional dependencies which are considered in all classical disciplines, but feed back effects. Levels of integration (structure, succession and hierarchy) are important to an understanding of the organization of the biotic world and the place of human beings and populations, including the functional relationships: part-whole role in ecosystems (Young 1989).

Human development in evolution (phylogeny) and ontogeny, is understood in human ecology as a process of adaptation and adjustment to environment. This process is the effect of interactions

between genetic determinants and environmental influences, interactions between human beings and society as environment, and interactions between human populations and ecological properties.

Another problem is the relationship between human ecology, medicine, pedagogics, engineering; technology of care and education of human beings and construction of their environment. Science, engineering and art are the three most important fingers of one hand, without any of them the hand is not fit, but any one is not more important.

Technology, like medicine, pedagogics, engineering is a very important part of our knowledge, but is not a science. Technology based on precise methods is very important for scientific experiments, but it is not in itself science.

CONCLUSIONS AND CLOSING REMARKS

It is important to summarize and mention, that two parallel «human ecologies» are recognized: (1) academic human ecology, as a scientific discipline, and (2) action-oriented human ecology, which is a technology (sociotechnology, environmental engineering, environmental protection, education to environment) of human actions related to environmental problems. Environmental engineering is about human influence on the environment (anthropopressure) and how to minimize environmental degradation. Environmental protection is about how to limit impairment of water, air and land quality. The branches of environmental epidemiology (the study of environmentally related diseases) and environmental health (the study of healthy environmental conditions), are being developed.

Human ecology is an interdisciplinary science. These kinds of studies are much more complicated than in classical disciplines. Monodisciplinary studies require education in one field, interdisciplinary in several branches or at least experiences in several scientific disciplines. The realization of interdisciplinary studies themselves are much more difficult for people from the social sciences than for those with biological training.

People with biological education can acquire needed knowledge of social sciences «at work» without special studies, but this is

not possible for persons with social science education, probably because of the difficulties of understanding physiological processes, genetic regularities, etc. without basic biological studies.

Development is a contradiction of continuation, negation of the existing status, a transition from known to unknown, from conceivable so that to understand it. The development of a human being has a physical and socio-cultural dimension. Humans mature not only sexually but also socially and culturally (on the emotional, intellectual, and moral plane). This development proceeds in a specific environment, primarily in the family and under the influence of a larger social group. This is the role of studies in the field of human ecology—to understand the factors shaping human beings in the physical and spiritual-mental aspects—through their bodies and organismal functions, through the material culture (man-made environment) and nonmaterial culture (unreal environment, products of fantasy and emotion) in which we are as deeply rooted as in the physical environment. As we have pointed out, the settlement and the household created by a society are of crucial importance in these processes. By the end of 20th Century these are probably also the most important areas of research.

ABSTRACT

This paper presents the reflections of its author about human ecology, its scope and the problems it faces on the eve of the XXI Century. He analyses the varieties of human adaptation and presents a series of diagrams with the synthesis of his concepts.

RESUMEN

Este trabajo presenta las reflexiones del autor sobre la ecología humana, su campo de estudio y los problemas que enfrenta poco antes del inicio del siglo XXI. Analiza las variedades de la adaptación humana y ofrece una serie de cuadros sinópticos que sintetizan sus conceptos.

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