

## Human Biological Evolution and Cultural Evolution Proceed in Concert - A Short Communication

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### INTRODUCTION

Biological evolution is a population-level process guided by selection and, in small populations, also by different random processes. In the biological world selection is targeted at individuals and based on the differences of their genes. In the latter half of the 19<sup>th</sup> century Charles Darwin, the father of the theory of evolution, described two types of selection. The first type of selection is natural selection [1]. It is based on the differential survival and reproductive capacity of the individuals. The second type of selection is sexual selection [2]. Sexual selection means that individuals tend to select their reproductive partners so that the offspring receive the most favorable genes possible regarding both natural and sexual selection.

In the theory of evolution, the concept of 'fitness' is central. 'Fitness' is the relative capacity of the individual to produce fertile offspring; in other words, to have its genes represented in the gene pool of the next generation. It must be stressed that fitness is a relative concept; the individual in question is compared to the other individuals of the population, and, more-over, fitness is dependent on the environmental circumstances in which the individual is living. A given individual which has a good fitness in a given environment can have poor fitness in some other environment.

In general, fitness is constituted of two components, the survival component and the reproduction component. To be fit, an organism must survive until reproductive age and then reproduce. In addition to this, many animals, notably several birds and all mammals possess a third component of fitness which may be called a 'fostering' or 'nursing' component. By this, it is meant that these animals, to be fit, must foster their offspring until they reach their reproductive age. In man this third component of fitness is very significant – apparently more significant than in all other mammals.

As, by definition, individuals with good fitness, reproduce most, the mean fitness of the population increases. In other words, the frequencies of alleles, which offer the best fitness, increase.

The universal principles of biological evolution, as for man as well, thus regarding also man, are the following three: the principle of variation, the principle of inheritance and the principle of selection. These principles comprise all the necessary conditions for biological evolution of all species, including man. Thus, together they also constitute a sufficient condition for biological evolution [3,4]. If these principles are in force, biological evolution necessarily follows.

Cultural evolution, or the development of cultures, can be defined as the change of the behavior of individuals through learning from one individual by another.

A parallel can very well be drawn from cultural evolution to biological microevolution – though less so to biological macroevolution. Researchers of the topic are rather united regarding the hypothesis that cultural evolution in general mainly obeys the same regularities as biological evolution, even though considerable differences exist.

For example, it is worthwhile to emphasize that while the conditions for biological evolution are universal, the conditions for cultural evolution are species-specific – in this case specific for man.

It is quite clear that the necessary conditions for the development of culture also include the principle of variation, the principle of inheritance and the principle of selection. However, these are not all the necessary conditions for cultural evolution, and thus, conversely to biological evolution, they, as a group, do not constitute a sufficient condition for human cultural evolution. It seems that all the necessary conditions are not even known yet, but

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evidently at least the following six phenomena belong to them: the storage, collection and accumulation of information, formation of social groups, work and division of labor between individuals, the subsequent development of society and spoken language as the sixth.

Organisms are adapted to the environmental circumstances where they live. This means that they can produce so much offspring that the relative number of fertile individuals in the population does not decrease. In other words, the mean fitness of the population remains constant or increases. In the biological evolution fitness is a simple index which measures the reproductive success of individuals. The question arises regarding whether a corresponding success index appears in cultural evolution.

The concept of 'cultural fitness' has been proposed for such an index by WH Durham, the American biological anthropologist [5]. Cultural fitness is defined as a function of time. The longer the period of time that a cultural character is preserved and transmitted from one individual to another in the population, the better it's cultural fitness.

This formulation of the concept of cultural fitness must, however, be regarded as too simple due to the fact that the preservation of a cultural trait is dependent on the number of learning chances an individual has to adopt the trait. At the same time, it has been proposed that the course of cultural evolution can be predicted precisely on the basis of the number of repeats of the learning event in the population [6].

The main significance of the foregoing reasoning is, however, that while the progress of biological evolution can be expressed in numbers of individuals; the progress of cultural evolution can be expressed by measuring the length of time that a given cultural trait or character is preserved and transmitted in the population.

Considering cultural evolution, it is self-evident that biological evolution must have produced the conditions for its existence. In other words, cultural evolution is a product of biological evolution. On the other hand, cultural evolution has changed and continuously changes our behavior in such a way that it affects our biological evolution. An illustrative example is the evolution of erect walking on two feet, where behavioral changes associated with it affect anatomical and physiological changes and vice versa. Many other examples of this kind of evolutionary feedback loops have been described demonstrating the fact that biological and cultural evolution of man proceed in concert.

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