

Contents lists available at [ScienceDirect](https://www.sciencedirect.com)

Futures

journal homepage: www.elsevier.com/locate/futures

The end of selection as a driver of human evolution

Hippokratis Kiaris*

Department of Drug Discovery and Biomedical Sciences, College of Pharmacy & Peromyscus Genetic Stock Center, University of South Carolina, Columbia, SC, USA

ARTICLE INFO

Keywords:

Evolution
Human
Mankind
Drift
Metahuman
H. sapiens

ABSTRACT

The future of human evolution triggers many discussions, in the intersection of biological, technological, and philosophical enquiry. I will discuss the proposition that the evolution of the human species will rely increasingly in stochastic phenomena in the future, by a manner at which selection will play a minimal role only. This is the direct consequence of our cultural evolution that was intensified after the Enlightenment and combined with the scientific, technological, and medical advances of our civilization, renders the perseverance of our species, as its ultimate goal. This supersedes the goals instructed by biology alone as they apply to all other species. To that end, H. sapiens will be the first and only species that through its logic-based progress, defies the rationale of natural selection as an evolutionary force and forecasts a rather unpredictable future path.

Contemplating on our species' evolutionary future serves multiple purposes: First, it contributes a sense of self-awareness that positions humans in a specific context in terms of time and in relation to the other species and the environment. Second, it provides a perspective for our future as it assists in evaluating ongoing trends, and probably, contributes to the appreciation of their long-term ramifications. Finally, it satisfies our curiosity regarding our origins and outlines a potential path forward.

So far, discussions regarding the fate of mankind are predominated by the prediction of doomsday events that are perceived as unavoidable, or the development of technologically enhanced metahumans (Bacon & Swindles, 2016; Bostrom, 2005; Vita-More, 2019; Wagler, 2021). Alternatively, misguided epigenetic interpretations, that remain borderline to the science fiction genre, tend to speculate that humans will evolve different physical characteristics, for example bigger heads and weaker bodies or teeth, to satisfy the changing demands of our technology-intense and comfort-seeking society. In other cases, serious attempts are being made to forecast humanity's future, but they essentially rely on the assumption that the human species will change culturally but not biologically (Bostrom, 2004, 2009).

In order to forecast the evolutionary fate of our species we need to consider the unique dynamics that have developed throughout our history and to consider the combined consequences of both biology and culture. While culturally, we will admittedly evolve through the change of our established valued systems and the technological progress, at the same time changes in our collective biological identity will also occur. To reflect on these changes requires multidisciplinary team efforts that besides biologists will also engage environmental, as well as social and political scientists, and philosophers. While this may appear presently only as an intellectual exercise, the exponentially accelerated technological progress and its relationship with our culture, mandates the appreciation of the established trends and of their impact.

Biological evolution is driven by a combination of forces that typically include selection, genetic drift, gene flow and mutations.

* Corresponding address: CLS 713, 715 Sumter Str., Columbia, SC 29208-3402, USA.

E-mail address: hk@kiarislabs.com.

<https://doi.org/10.1016/j.futures.2022.103038>

Received 12 May 2022; Received in revised form 6 September 2022; Accepted 12 September 2022

Available online 15 September 2022

0016-3287/© 2022 Elsevier Ltd. All rights reserved.

Among those, selection is guided by adaptive changes that increase the individuals' or the populations' reproductive success that reflects their biological fitness, while the others involve stochastic events and processes that over time may conclude in speciation (Dawkins, 1976, 1982; Okasha, 2006a, 2006b; Okasha, 2001; Wilson, 1975; Wilson, 1980; Wilson, 1989). These forces together, acting in combination, operate continuously in all species and more than 300,000 years ago resulted in the evolution of *H. sapiens*.

Humans also developed culture that over time is also evolving, it represents an indispensable component of the human identity, and alters the way people live their lives, arguably improving them. Cultural evolution started simultaneously with the appearance of *H. sapiens* and of its social organization in prehistorical times but was intensified in the last 12,000 years after the discovery of agriculture, when social organization became more complex and hierarchical.

Irrespective of the specific culture and civilization that is examined, a common feature of all cultural developments, throughout human history, was that within the population group with which people identified themselves, special provisions were always made to benefit the members of the group, irrespective of their biological fitness. Sick people, the elderly or those bearing certain disadvantages were taken care of, in ways that defeated biological rationale. Hereditary privileges of certain individuals and their lineages were frequently also in effect that further disrupted the biological logic of selection which is based on biological fitness. Depending on the specific social organization and the society's mode of operation, some members of the group were benefitted more than others, but all, at a certain extent, profited by claiming the group membership. To that end, individuals with a strictly perceived, biologically "reduced" fitness were aided by their participation in the group in a manner and at an extent that was surpassing the typical altruistic behavior seen in other social animals. Resources were made always available and when individuals became sick or less capable, were taken care of, in adherence to the social norms that were established historically by the group. This operated, not in anticipation of recovery or seen as a biological investment towards another member of the group, but rather as an action dictated by the existing moral codes. Group selection may explain this to some extent but the ever-increasing size of the target group across history implies the operation of codes that surpass pure biology. Furthermore, the society was organized in a manner at which all, depending on their abilities and their individual characteristics, were integrated in the society, and would receive at some extent the benefit of group membership. Such benefits, albeit not distributed uniformly in the society, at minimum targeted essential needs such as food, shelter and protection, and reduced variations in reproductive efficiency and therefore, biological fitness in the population.

The extent of the group varied a lot at different historical periods and geographical locations and ranged from a band of closely related individuals to larger population groups such as whole nations, religious groups, or the citizens of past and present-day states. This trend was further cultivated in the Enlightenment at which a globalized humanitarianism was advocated that peaked at the modern times (Warthon, 1983). According to these values, the group, at which the recipient of the benefits is justifiable, has received its maximal breadth involving the whole mankind. Today, concomitantly with the strengthening of social welfare states, a culture is being fixed in our society, especially in the Western world, according to which the human identity alone is sufficient to justify entitlement of the benefits of progress, independently of the specific group the individuals are members. It is becoming common sense in our Western civilization that developed nations should assist the ones that are underdeveloped, similarly to our moral personal obligation to assist those in need within our society. This is related to a deep comprehension of a collective species' conscience and is reflected to the humanitarian ideals that target all mankind. Despite the inequalities of the past and the present times, this predominant cultural norm relies on the premise that at least the essential biological needs, those that may impact directly or indirectly reproductive success and therefore biological fitness, should become readily available to all people.

In parallel with this culture of increasingly impartial care against others, progress in science and technology enabled and intensified this attitude. While all other species adapt passively to the changes, by avoiding for example unfavorable conditions, humans actively alter their environment to their benefit, in an effort to eliminate the pressures inflicted by it. This reflects an extension of the *niche construction* principle according to which different species induce small-scale changes to their environment to make it more suitable (Laland et al., 1999; Laland et al., 2017). Under these conditions the intrapopulation variation, that would otherwise have provided the pool for evolution-based selection is not causing, or it is sought not to cause, differences in the peoples' fitness. Instead, it aims to render without discrimination, all people resistant to such environmental changes and pressures, optimizing their survival and life performance. The same principle applies to technology, medical and not, that aims to eliminate the effects of biology in determining reproductive success.

This is a direct and consciously pursued choice of our species and is due to a combination of factors that emerged during the historical period of our cultural evolution. Progress in medicine, science and technology establish an ongoing trend by which external environmental and internal biological factors are not limiting our ability to live, reproduce and achieve our maximal lifespan. This is attained independently of our individual abilities and capacities that otherwise could pose limitations. Obviously, we are currently before this ideal state, yet it is an aspiration that will likely be achieved in our future. Within this ongoing process, today we can recognize that those at which such benefits are more readily accessible are not the ones that earned it through some biological trade-off. For example, those that enjoy most of the benefits are not necessarily the ones that will leave fewer descendants, and the ones that do not, are not always the ones that will have more offspring. Alternatively, it is not due to some selection process and a biological justification for the better access of some but not others, to the benefits of medical and technological progress, and of course shouldn't be. From a genetic perspective this can be seen as coincidental since it does not reflect some increased ability to justify the different outcomes. In other words, those that have higher access to the benefits of progress did not "earn" it on the basis of some increased ability that offers a biological advantage. In terms of biology this is random and coincidental, guided by historical or stochastic factors. Thus, the operation of biology has been defeated. Even in the liberal capitalistic societies at which inequality is morally justified, income-related differences are unacceptable when they influence the efficiency of offspring production, that in turn impacts fitness and represents the absolute driver of evolutionary transformations. Cultural developments that started during the historical period and intensified after the Enlightenment, consciously promoted a globalized humanitarianism that progressively aims to pass the benefits of

progress to all people.

Since the earliest period of history and prehistory various modes of organization were incepted for our societies that aimed to efficiently accommodate and integrate all members of the group, in a manner at which the efficient operation of the whole society would ultimately benefit all people, irrespectively of their individual capacities. Obviously, this was always heavily influenced by the historical perceptions of what well-being is and varied dramatically, both quantitatively and qualitatively, across location and time. Nevertheless, the quest was how a given group, and all individuals within it, could have benefitted at the most. Occasionally, diametrically opposing avenues were followed, but the ultimate goal was always to benefit, at some extent, all members of the group. These trends are active today and it is plausible they will be dominant in the future as well. We can easily envisage a future society in which progress in medicine and technology will be able to provide unprecedented capacities for our well-being, at least in terms of satisfying our essential biological needs. Such benefits, in view of the cultural trends we have established will be accessible to a constantly increasing, albeit disproportionately, population base. In that case, natural selection, at least as viewed from a biological standpoint and interpreted as reproductive efficiency, will cease to operate as a force of evolution.

Gene-culture coevolution has been recognized, especially during the earlier stages of evolutionary history and was linked to group selection that explained altruistic behavior (Wilson & Wilson, 2007; Mesoudi, 2016). It was attributed to the fact that rapid cultural changes were imposing pressures to the slower occurring changes in gene frequency, driving evolution forward (Bradie & Bouzat, 2016; Dijkster, 2011; Richerson & Boyd, 2005; Richerson et al., 2010). As suggested, this might explain the fixation of altruistic behavior as well as morality and other character virtues (Gintis, 2011). Nevertheless, today, the established cultural norms attempt to nullify the impact of such pressures, rendering them irrelevant to our evolutionary future and our biological function in society.

It could be posed that traits facilitating tasks such as those required by a future technologically intense society or egalitarian culture will guide the future evolutionary dynamics of the human species. This may be true if we extend the definition of fitness to social and cultural abilities. In that case, in the long run, egalitarian ideals may be culturally selected shaping future cultural trends. However, to operate as such, at the biological level they need to be linked to clear reproductive advantages. Nevertheless, ongoing cultural trends eliminate such association because even if certain individuals benefit most in such societies now, and will do so in the future as well, this will not be translated to an increased biological fitness for them. Indeed, children number does not correlate today with financial or educational and societal status, while richer countries have lower birth rates, both of which show that reproductive performance is not limited by resource availability (Eurostat, 2021). To that end, through our cultural development, that was enabled by our ongoing progress in science and technology, the perseverance of our species as a single entity, has been elevated to the status of a goal that nullifies evolutionary pressure due to selection. Every possible effort is being made to maintain the current gene pool of the human species by alleviating, through technological innovation, potential disadvantages that are associated with certain harmful gene alleles. Historically, such alleles were retained in the population due to their low frequency or their recessive character. In the future, this will be assisted also by mitigating their harmful consequences through medical interventions. Such mindset transcends our species and extends to other species as well, as reflected to our attempts to sustain biodiversity and to preserve species that could otherwise go extinct by environmental pressures, inflicted directly or indirectly largely by humans.

However, evolution will not cease to operate. Since as species we are engaged in the neutralization of the selection forces posed by our environment, the remaining factors that can drive it remain random and unpredictable, and include drift, gene flow (to the extent that isolated populations will exist) and mutations. Such events may include catastrophic events and diseases that can eliminate large portions of the population causing genetic bottlenecks. They may even relate to founder effects that can cause genetic isolation of subgroups of people (Arias-Maldonado, 2020; Bacon & Swindles, 2016; Keys et al., 2019; Wagler, 2021). Geographical isolation may now relate to culturally inflicted isolation of groups of people, pointing to the impact that the historical factors may exert to human evolution. Provided that the optimistic scenario is confirmed, and medical and technological progress become available to all, eliminating reproductive disparities, increased inequality may pose strict social barriers in the future that will isolate genetically, groups of people. As discussed, such process would be random and dissociated from biological benefits for the individuals affected. Alternatively, isolation may be attained by the colonization of distal planets which according to futurists may be also linked to founder effects. Nevertheless, all will have to operate within a cultural environment in which irrespectively of the advantages they may presumably confer biologically, the established and ongoing societal norms reassure that they will not benefit specifically the individuals that bear them, in terms of their reproductive efficiency. More importantly, even if such events are able to cause sufficient alteration of the genetic identity of populations of humans, their source will be a stochastic event that will be dissociated from the biological fitness of people. It will not be the outcome of selection. Thus, evolution of the human species will become increasingly dependent on random events that as such, in the absence of selection, may lead to the dominance of meta-humans that may have, with theoretically equal chances, either higher or lower fitness compared to our current version. Whether such differential fitness translates into better societies and happier people is not self-evident but its ramifications in the evolutionary dynamics of *H. sapiens* are plausible. It should be taken into consideration that the genetic makeup of different populations may influence their tendency for different cultural characteristics (Chiao & Blizinsky, 2010; Kiaris, 2021). If this is the case, it is plausible that these tendencies will be either consistent or they will not be consistent, with the established ideals of our current culture, at variable degrees. If they are consistent, the evolution of humans will remain stochastic relying on the randomness of bottlenecks and isolation. If they are not, and the established widespread humanitarianism is compromised, selection may be re-instated as an evolutionary force.

Taken together, these notions imply an ironic controversy: The cultural evolution of the human species, through its technological and scientific achievements that are based in pure logic, succeeded in defeating the evolutionary logic at which selection is instrumental. This is inherently related to the Western ideals that especially after the Enlightenment promoted a widespread and impartial humanism that extends to the whole mankind.

Interdisciplinary teams that among others should include biologists, social scientists and philosophers need to assemble, to

integrate biology into the ongoing discussion for the cultural fate of humanity. If this essay succeeds in initiating such conversation it will have accomplished its mission.

Data Availability

No data was used for the research described in the article.

Acknowledgements

I thank Charalampos Kiaris for his constructive criticism and suggestions.

References

- Arias-Maldonado, M. (2020). Sustainability in the anthropocene: Between extinction and populism. *Sustainability*, 12, 2538. <https://doi.org/10.3390/su12062538>
- Bacon, K. L., & Swindles, G. T. (2016). Could a potential Anthropocene mass extinction define a new geological period? *The Anthropocene Review*, 3(3), 208–217. <https://doi.org/10.1177/2053019616666867>
- Bostrom N. The future of human evolution. *Death and Anti-Death: Two Hundred Years After Kant, Fifty Years After Turing*, ed. Charles Tandy (Ria University Press: Palo Alto, California, 2004): pp. 339–371.
- Bostrom, N. (2005). A history of transhumanist thought. *Journal of Evolution and Technology*, 14(1), 1–25.
- Bostrom, N. (2009). The future of humanity. *Geopolitics, History, and International Relations* (Vol. 1,(No. 2), 41–78.
- Bradie, M., & Bouzat, J. L. (2016). Patterns and processes in cultural evolution. *Evolutionary Biology*, 43, 516–530. <https://doi.org/10.1007/s11692-015-9342-7>
- Chiao, J. Y., & Blizinsky, K. D. (2010). Culture-gene coevolution of individualism-collectivism and the serotonin transporter gene. *Proceedings Biological Sciences*, 277 (1681), 529–537. <https://doi.org/10.1098/rspb.2009.1650>
- Dawkins, R. (1976). *The selfish gene*. Oxford: Oxford University Press.
- Dawkins, R. (1982). *The extended phenotype*. Oxford: Oxford University Press.
- Dijker, A. J. M. (2011). Physical constraints on the evolution of cooperation. *Evolutionary Biology*, 38, 124. <https://doi.org/10.1007/s11692-011-9119-6>
- Eurostat 2021. European Commission Statistics (https://ec.europa.eu/urostat/statistics-explained/index.php?title=Fertility_statistics).
- Gintis, H. (2011). Gene-culture coevolution and the nature of human sociality. *Philosophical Transactions of the Royal Society B: Biological Sciences*, 366(1566), 878–888. <https://doi.org/10.1098/rstb.2010.0310>
- Keys, P. W., Galaz, V., Dyer, M., et al. (2019). Anthropocene risk. *Nature Sustainability*, 2, 667–673. <https://doi.org/10.1038/s41893-019-0327-x>
- Kiaris, H. G. (2021). *Polymorphisms, and the Making of Societies: A genetic perspective for the divergence between East and West*. Boca Raton: Universal Publishers,.
- Laland, K., Odling-Smee, J., & Endler, J. (2017). Niche construction, sources of selection and trait coevolutionInterface. *Focus*, 72016014720160147. <https://doi.org/10.1098/rsfs.2016.0147>
- Laland, K. N., Odling-Smee, F. J., & Feldman, M. W. (1999). Evolutionary consequences of niche construction and their implications for ecology. *Proceedings of the National Academy of Sciences USA*, 96(18), 10242–10247. <https://doi.org/10.1073/pnas.96.18.10242>
- Mesoudi, A. (2016). Cultural evolution: A review of theory, findings and controversies. *Evolutionary Biology*, 43, 481–497. <https://doi.org/10.1007/s11692-015-9320-0>
- Okasha, S. (2001). Why won't the group selection controversy go away? *British Journal for the Philosophy of Science*, 51, 25–50.
- Okasha, S. (2006aaa). *Evolution and the levels of selection*. Oxford University Press. <https://oxford.universitypressscholarship.com/view/10.1093/acprof:oso/9780199267972.001.0001/acprof-9780199267972>.
- Okasha, S. (2006bbb). *Evolution and the levels of selection* (p. 263). Oxford: Oxford University Press.
- Richerson, P. J., & Boyd, R. (2005). *Not by genes alone: How culture transformed human evolution*. University of Chicago Press.
- Richerson, P. J., Boyd, R., & Henrich, J. (2010). Colloquium paper: Gene-culture coevolution in the age of genomics. *Proceedings of the National Academy of Sciences USA*, (Suppl 2), 8985–8992. <https://doi.org/10.1073/pnas.0914631107>
- Vita-More, N. (2019). History of transhumanism. In N. Lee (Ed.), *The Transhumanism handbook*. Cham: Springer. https://doi.org/10.1007/978-3-030-16920-6_2.
- Wagler, R.. "Anthropocene Extinction." Access Science, McGraw-Hill Education, Jan. 2021.
- Warthon, Patricia Margaret. "THE HUMANITARIAN MOVEMENT IN EUROPEAN HISTORY." *Il Politico*, vol. 48, no. 4, 1983, pp. 693–726, (<http://www.jstor.org/stable/43097041>).
- Wilson, D. S. (1975). A theory of group selection. *Proceedings of the National Academy of Science*, 72, 143–146.
- Wilson, D. S. (1980). *The natural selection of populations and communities*. Menlo Park, CA: Benjamin Cummings.
- Wilson, D. S. (1989). Levels of selection: an alternative to individualism in biology and the human sciences. *Social Networks*, 11, 357–372.
- Wilson, D. S., & Wilson, E. O. (2007). Rethinking the theoretical foundation of sociobiology. *Quarterly Review of Biology*, 82, 327–348.