

Sapiens: A Review Under the Perspective of The Evolutionary Neuroscience

Sapiens: Uma Revisão Sobre a Perspectiva da Neurociência Evolutiva

Sapiens: Una revisión Sobre la Perspectiva de la Neurociencia Evolutiva

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Resumo

Neste trabalho, apresentamos uma revisão crítica do livro: **Sapiens: Uma Breve História da Humanidade**, de Yuval Noah Harari, versão traduzida para o português, publicada em Porto Alegre, Brasil, em 2017. Embora o livro traga contribuições para diversas áreas da ciência, nossa abordagem pretende avaliar apenas as ideias relacionadas ao campo da neurociência evolutiva em geral, principalmente no que diz respeito às origens comportamentais, aspectos sociais e emocionais de nossa espécie tratadas pelo autor. Assim, entendemos que este livro traz importantes reflexões sobre os temas propostos, cumprindo uma dupla função. Primeiro, atuando como instrumento de disseminação da ciência ao público leigo. Segundo, discutindo importantes aspectos da neurociência evolutiva, para a comunidade acadêmica e científica.

Unitermos. Evolução Biológica; Neurociência Evolutiva; Comportamento social; Emoções

Abstract

In this work we present a critical review of the book: **Sapiens: A Brief History of Humanity**, by Yuval Noah Harari, version translated into Portuguese, published in Porto Alegre, Brazil, in 2017. Although the book brings contributions to several areas of science, our approach intends to evaluate only the ideas related to the field of evolutionary neuroscience in general, especially regarding the behavioral origins, social and emotional aspects of our species treated by the author. Thus, we understand that this book brings important ruminations about the proposed themes, fulfilling a dual function. First, acting as an instrument for the dissemination of science to the lay public. Second, discussing important aspects of the evolutionary neuroscience, for the academic and scientific community.

Keywords. Biological Evolution; Evolutionary Neuroscience; Social Behavior; Emotions

Resumen

En este artículo, presentamos una revisión crítica del libro: **Sapiens: A Brief History of Humanity**, de Yuval Noah Harari, traducido al portugués, publicado en Porto Alegre, Brasil, en 2017. Aunque el libro aporta contribuciones a diversas áreas de la ciencia, nuestro enfoque pretende evaluar solo las ideas relacionadas con el campo de la neurociencia evolutiva en general, principalmente en relación con los orígenes conductuales, los aspectos sociales y emocionales de nuestra especie abordados por el autor. Por lo tanto, entendemos que este libro trae reflexiones importantes sobre los temas propuestos, cumpliendo una doble función. Primero, actuar como un instrumento de difusión de la ciencia al público laico. Segundo, discutiendo importantes aspectos de la neurociencia evolutiva para la comunidad académica y científica.

Palabras clave. Evolución biológica; Neurociencia evolutiva; Comportamiento social; Las emociones

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THE REVIEW

In this paper, we present an overview of Harari's work¹, concentrating our analysis about the parts of the book that deal with important reflections in the field of evolutionary neuroscience. To fulfill this goal, we assume that the approach in evolutionary neuroscience must be multidisciplinary², involving not only neurobiology aspects, but also social scientists, cognitive, computational, medical, and above all anthropological scientists³, especially when we want to explore the implications of neuroscience for understand culture and social behaviors⁴. Therefore, the fact of the author of this book to be a historian does not disqualify him to approach the proposed themes.

Thus, the work of Harari is divided into five chapters that relate the main biological and cultural developments of humanity: the cognitive revolution; the agricultural revolution; the unification of humanity; the scientific revolution; and the epilogue: the animal that became a god.

Initially the book deals with the *hominini* ancestral, the *Astralopithecus*, about two million years ago, and the origins of the various human populations in East Africa (*Homo rudolfensis*), East Asia (*Homo erectus*), Indonesia (*Homo*

soloensis) and Europe or Western Asia (*Homo neanderthalis*) until the appearance of *Homo sapiens*.

The work is not simply an ordering of chronological facts and anthropological evidence, Harari constantly urges the reader to exercise a critical view about the modern society.

The author leads us to question that even about to human evolution "there are two sides to every coin!", remembering the tragic face sometimes hidden or conveniently overlooked of this evolutionary process. It is possible to infer from several passages that the overcoming saga of modern *Homo sapiens* under the environment (usually seen as a symbol of biological supremacy) is also the source of problems ranging from biological aspects (health related), social (emotional and ethical), and even economic.

For example, he cites at least three events of mass extinction with signs of human causality. Among these events, the disappearance of more than 24 species of large animals in Australia with the arrival of *H. sapiens* 45,000 years ago, or the arrival of Maori, the first *sapiens* in New Zealand, coinciding with the extinction of a large part of the local fauna, in addition to 60% of all species of birds (p. 77)¹. Concluding that humans have caused the extinction of nearly half of the world's great animals throughout their saga for survival, and how this may have influenced in our social behavior.

From Anthropology to Neurobiology. Harari argues how the agricultural revolution and the cooking of foods possibly

allowed the development of the human brain (because of the greatest caloric intake in the diet) and consequently development of the most varied psychosocial capacities. In fact, studies such as that of the Brazilian neuroscientist, published by the Proceedings of the National Academy of Sciences (PNAS), present robust evidence about this hypothesis and suggest the same conclusion⁵.

However, about this issue, it should be remembered that current discussions consider that increase of the brain size does not necessarily contributes to the emergence of complex specializations. For example, African elephants have 257 billion neurons, three times more than humans, with 86 billion neurons. In the case of these elephants, 98% of their neurons are concentrated in the cerebellum. All other mammals had most of the neurons in the same region but never exceeded an 80% concentration rate. Thus, only 5.6 billion neurons are in the cerebral cortex of these elephants, while humans have 16 billion neurons in that region and concentrated in a much smaller brain. In other words, it is possible that the cognitive capacities considered superior in the human brain may be the result of the incredibly large number of neurons concentrated in the cerebral cortex⁶.

For Harari, the increase in brain size associated with the increase in metabolic demand allowed by agriculture has created a form of "dependency." Thus, he asserts that in fact, plants domesticated the humans, not the opposite (p. 90)¹. Then, when the agriculture arises, humans spent thousands of years selecting subtypes of species that were more

resistant or adapted to the environment, which in the last analysis has also influenced the social behavior of the human being. He also argues that this type of behavior has generated several health problems (musculoskeletal) not necessarily due to bipedalism but to the new type of physical work involved in cultivation and harvesting. In fact, some studies corroborate this hypothesis⁷.

In this aspect, according to Harari, the "cognitive revolution" is the fruit not only of the greatest caloric intake in human diet, but also of the emergence of a peculiar characteristic: the ability to create imagined principles.

The author defines these principles as: concepts that do not exist in material or physical reality, existing only in the human mind. As examples, he cites social values, territorial boundaries, religion, the value of money, and the laws themselves. In other words, cultural constructs that do not alter objective reality (which exists independently of the human imagination).

Thus, the "culture", in the hypothesis defined by the author, is the result of the appearance of imagined principles and is an important mechanism of evolutionary adaptation, since it would have increased the possibility of survival. He argues that these imagined principles would have been fundamental, for example, for the creation of networks of mass cooperation, which could have helped *H. sapiens* to overcome opposing groups, hostile environments or periods of scarcity: "*the capacity to create an imagined reality with*

words made it possible for a large number of strangers to cooperate effectively" (p. 41)¹.

At this point, it would have been important that the author had presented the idea that evolutionary genetics allowed the emergence of networks of mass cooperation in nature, even for organisms who do not have the capacity to create imagined realities. Organisms such as bees, termites, wasps and some vertebrates like the mole rat, exhibit similar social behavior, where the older ones "take care" of the younger ones, or where there is a large organized social group with different functions⁸. Therefore, a more conservative approach in our analysis, stating that the imagined principles were an important but not essential feature for the emergence of social co-operation behavior.

The author also presents a hypothesis for the disappearance of the *Homo neanderthalensis*, due to the inability to create fictions (common ideals for which to fight or to unite) that may have created difficulties in cooperation, especially for the formation of large groups. Thus, making them fragile in great combats against the *Homo sapiens*, although they (the *H. neanderthalensis*) were physically more robust and with a larger skull.

In fact, the reasoning is consistent. The available evidence points to a time when *Homo sapiens* would have coexisted with *H. neanderthalensis*. Recent studies are focused on analyzing of the possible effects of Neandertal D.N.A on human health^{10,11}. Thus, although mass cooperation exists in species that do not have the ability to

create imagined realities, in theory, this ability could increase this cooperation, giving a greater probability of survival to the group.

In this context, it is necessary to repeat our restriction regarding the author's claim when he affirms as directly proportional the relations of cranial size and cognitive capacity. In fact, the *H. neanderthalensis* did have a larger skull, but as we have explained earlier, size does not reflect better adaptability or greater probability of developing complex cognitive activities.

For the author, just as the agricultural revolution on the one hand increased the probability of survival and development of the species, but on the other, it provoked health problems. The cognitive revolution that promoted the capacity to create imagined realities and increase the survival of the human species, also fomented the appearance of several undesirable characteristics at the present, that afflict the social conviviality of the species.

In fact, it is possible to deduce that the creation and development of today's complex societies was only possible through the creation of intangible concepts such as: human rights, territory, nation, currency, commerce, etc.

Thus, it is possible to conclude that each of these concepts, acting to increase the chances of survival, but also, created a corresponding undesirable social characteristic. For example, the notion of territory possibly allowed a survival advantage, but also created collective and violent confrontations between beings of the same species. Moral

concepts, such as respect for laws and customs, allowed the harmonization of the conviviality of larger groups, but on the other hand the emergence of preconception and xenophobia.

About this, important reflections need to be made: would it be the xenophobia really a disadvantage from an evolutionary biological point of view? When the human being still lived from fishing and hunting, in small groups (without the domain of agriculture) would it be advantageous to have countless other beings of the same species disputing the scarce resources around?

Harari ventures and answers this question by stating, "*Evolution made Homo sapiens, a xenophobic creature. The sapiens divide humanity into two parts, us and them*"(p. 203)¹.

In this regard, the Israeli zoologist Amotz Zahavi, in a famous article published in 1975⁹, helped to create the term "*potlatch effect*" when he analyzed the supposed altruistic behavior of small male Arab-busting birds that feed other males. Theoretically, what evolutionary advantage could exist in help another male who would be (in future) a rival for the females? In the conclusion of the zoologist, the zagateiros exercise their dominance feeding subordinates, a demonstration of strength and superiority, which ultimately guarantees the females of the group and consequently, could not be considered altruism.

Thus, our general conclusion about the work is that it contributes to important debates on themes that cover evolutionary neuroscience, since it discusses aspects of

social evolution, biological evolution and emotional evolution. Of course, many points about these issues are especially current and relevant in academia, as they need to be clarified and will be the subject of current and future research.

Although some of the conclusions drawn by the author about the topics covered (regarding evolutionary neuroscience) still lack of robust evidence to support them, due to the complexities of the themes involved, this does not diminish the general importance of this book under the scientific perspective.

In addition, we understand that this work still fulfills an important social function in the scientific dissemination. When dealing with these subjects in the form of stories and avoiding academic jargon, the author makes the text attractive and accessible to the common public, thus fomenting even more the debate about these important themes in the areas of biological sciences, health, anthropology and sociology.

REFERENCES

- 1.Harari, Yuval Noah. Sapiens - Uma breve história da humanidade. Porto Alegre-RS: L&PM, 2017.
- 2.Dias AM. The foundations of neuroanthropology. Front Evol Neurosci 2010;2:5. <https://doi.org/10.3389/neuro.18.005.2010>
- 3.Campbell BC. Neuroanthropology: evolution and emotional embodiment. Front Evol Neurosci 2009;1:4. <https://doi.org/10.3389/neuro.18.004.2009>
- 4.Dalgalarondo P. Evolução do cérebro: sistema nervoso, psicologia e psicopatologia sob a perspectiva evolucionista. Porto Alegre: Artmed, 2011.

5. Herculano S. The remarkable, yet not extraordinary, human brain as a scaled-up primate brain and its associated cost. PNAS 2012;109(Suppl 1):10661-8.
<https://doi.org/10.1073/pnas.1201895109>
6. Herculano-Houzel S. The paradox of the elephant brain. The MIT Press. Available in: <http://mitp.nautil.us/feature/227/the-paradox-of-the-elephant-brain>
7. Walker-Bone K, Palmer K. Musculoskeletal disorders in farmers and farm workers. Occupational Med 2003; 52:441-50.
<https://doi.org/10.1093/occmed/52.8.441>
8. Hamilton WD. The genetical evolution of social behaviour. I. J Theor Bio 1964;7:1-16. [https://doi.org/10.1016/0022-5193\(64\)90038-4](https://doi.org/10.1016/0022-5193(64)90038-4)
9. Zahavi A. Mate selection - A selection for a handicap. J Theor Bio 1975;53:205-14. [https://doi.org/10.1016/0022-5193\(75\)90111-3](https://doi.org/10.1016/0022-5193(75)90111-3)
10. Dannemann M. The Contribution of Neanderthals to Phenotypic Variation in Modern Humans. Am J Hum Gen 2017;101:578-89.
<https://doi.org/10.1016/j.ajhg.2017.09.010>
11. Callaway E. How Neanderthal DNA might have shaped some human brains. Nature, 2018. Available in: <https://www.nature.com/articles/d41586-018-07770-7>