THE STRUCTURE OF THE DARWINIAN ARGUMENT IN THE ORIGIN OF SPECIES

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Keywords: argumentative strategies, Darwinian argument, Darwinian context, "Darwinian histories", empirical evidence, explanatory patterns, hypothetical-deductive argument, models, Natural Selection, tautology, *The Origin of Species*

Contents

Summary

Some of the best-known reconstructions of the general argument presented in Charles Darwin's *Origin of Species* attempt to show its hypothetical-deductive features. The Principle of Natural Selection is given as the necessary conclusion of the following premises: the Principles of Variation, the Struggle for Existence (sometimes referred to as Malthus' Principle), the Variation in Fitness, and Heredity.

A number of recent analyses of the Darwinian argument have been proposed using different approaches. The author will analyze some of the most representative of these, and emphasize that the hypothetical-deductive reconstructions conflict with an essential feature of deductive arguments, i.e. the independent support as regards each premise in relation to the others and to the conclusion. Several of these alternative reconstructions are important, but none of them explore what the author thinks is also a central feature in understanding Darwin's argument: the logical-conceptual structure of the *Origin*'s general argument based on the relationship between "Struggle for Existence", "Natural Selection" and "Nature" (concepts which are fundamental to the premises and conclusion of the argument). This approach leads to a reading of the *Origin of Species* as a narrative without a linear structure, but rather as a network made up of successive steps (chapters/partial arguments), each of which summarizes the preceding step, and introduces the subsequent ones. This conceptual movement backwards and forwards makes it easier to understand the issues concerning the origin of species, which constitute the entire "one long argument". On the one hand, the parts sustain the whole and, on the other hand, it is from the complete argument that each part (chapter/partial argument) derives its support and meaning. In this conceptual network, argumentative strategies play a decisive role.

Between 1859 and 1872, six editions of the *Origin of Species* were revised by Darwin himself. The 1872 edition will be the source for this analysis.

1. Introduction: The Hypothetical-Deductive Reconstruction

The general argument of the *Origin of Species* has had an interesting interpretative history. Initially, it was heavily criticized because it violated inductive principles. As Adam Sedgwick put it in a letter sent to Darwin on November 24th, 1859: "You have deserted – after a start in that tram-road of all solid physical truth – the true method of induction…[sic]". Commenting on Darwin's explanations of the formation of complex organs such as the eyes, Whewell criticized the assumption that the possibility of imagining a series of steps of transition from one condition of organs to another was to be accepted as a reason for believing that such a transition had, in fact, occurred, and that by imagining an unlimited number of generations for the transition to take place, all doubt that the transitions had really occurred would be eliminated.

Darwin himself seems to have felt ambiguous in relation to the originality of the structure of his argument. Did he see it as deductive or inductive? In his *Autobiography* he claimed that he followed inductive patterns: "**I worked on true Baconian principles and without theory collected facts on a wholesale scale…**". He also said that he would always abandon his most cherished hypotheses whenever the facts opposed them. Nevertheless, his son Francis tells us how much he enjoyed his "foolish experiments", those through which he liked to test hypotheses opposed to those which were commonly assumed. Darwin resented that great virtues were attributed to him as an observer, not as a theoretician. Passages from his correspondence show the deductive view he had of his own work. In a letter to Asa Gray from 20 July, 1857, he says: "**To be brief I *assume* that species arise like our domestic varieties with *much* extinction; and then test this hypothesis by comparison with as many general and pretty well established propositions as I can find made out – in geographical distribution, geological history – affinities &c &c &c. And it seems to me that supposing that such a hypothesis were to explain general propositions, we ought, in accordance with the common way of following all sciences, to admit it, till some better hypothesis be found out**".

Furthermore, in central passages of his work Darwin emphasizes that the *Origin of Species* must be viewed and evaluated as "one long argument". At key points in his work (in the Introduction, Chapter IV and the Conclusion), he makes statements which form the basis of contemporary hypothetical-deductive reconstructions of his argument. At the end of Chapter IV, these statements are as follows:

"If under changing conditions of life organic beings present individual differences in almost every part of their structure, and this cannot be disputed; if there be, owing to their geometrical rate of increase, a severe struggle for life at some age, season, or year, and this certainly cannot be disputed; then, considering the infinite complexity of relations of all organic beings to each other and to their conditions of life, causing an infinite diversity of structure, constitution, and habits, to be advantageous to them, it would be a most extraordinary fact if no variations had ever occurred useful to each being's welfare, in the same manner as so many

variations had occurred as useful to man. But if variations useful to any organic being ever do occur, assuredly individuals thus characterized will have the best chance of being preserved in the struggle for life; and from the strong principle of inheritance, these will tend to produce offspring similarly characterized. This principle of preservation, or the survival of the fittest, I have called Natural Selection."

On the basis of the above passage, the hypothetical-deductive reconstructions of the general argument of the *Origin of Species* are in line with the following:

1) There is variation among the members of a species (PV: The Principle of Variation – Chapters 1-2).
2) In each generation, more individuals are born than can possibly survive (PSE: The Principle of the Struggle for Existence – Chapter 3).
3) Some variations affect organisms' ability to survive and reproduce; some organisms are bearers of variations that favour their survival and reproduction (PVF: The Principle of Variation in Fitness – Chapters 2-4).
4) Inheritance is the norm (PI: The Strong Principle of Inheritance – Chapter 1).

Conclusion: Preservation of the variations that are favourable to their bearers and elimination of the injurious ones (PNS: The Principle of Natural Selection – Chapters 3 and 4).

The relationship between premises and conclusion seems to give the argument its deductive character: if the premises are true, the conclusion is necessarily true. At another, but no less important stage, PNS will be justified by its explanatory power in relation to facts (even the "strangest" ones), empirical regularities, laws, other principles, procedures, the solution of difficulties, aesthetic and religious feelings, and the encouragement of the advancement of knowledge.

2. Analyzing the Hypothetical-Deductive Reconstructions

The hypothetical-deductive reconstructions are frequently accompanied by additional indispensable comments by those who claim that Darwin's argument fits into this format, and these comments contribute to the understanding of the argument. Beginning with Michael Ghiselin's *The Triumph of the Darwinian Method* as a landmark in the reconstructions of Darwin's argument in hypothetical-deductive terms, the argument will be analyzed here by focusing on four major interrelated topics: the logical structure, the empirical support, the tautology problem, the historical reconstructions of the argument, and the bringing together of the history and philosophy of science in order to understand Darwin' argument. Like many of the reconstructions analyzed, Ghiselin's covers all the topics mentioned above. By taking these topics together in Ghiselin's case, the intention is to show how they are interconnected and mutually illuminating. Because of the limits imposed on the length of this paper, a number of important contributions to the understanding of Darwin's argument will not be analyzed.

2.1. A Referential Case

Ghiselin's reconstruction relies heavily on the hypothetical ("if") character of the premises of Darwin's argument. He points out that Darwin's view is strikingly modern in tone, in the sense that it emphasizes the possibility of falsification, whilst removing the fear of false hypotheses, and opening the path to truth. The sophistication of Darwin's method of problem-solving allows the building of a unitary system of interconnected ideas from the different areas in which he worked, those of natural history, geology, zoology, evolution, botany, and psychology. As a result, these areas of study provide supportive evidence to each other. In particular, Ghiselin calls attention to the epistemological revolution instigated by Darwin in order to understand the nature of evidence, and the indirect verification to which his theory is subjected: it is the system – and not the facts or theories in isolation – which should be tested, and it is within the unitary system that expressions such as " favoured races" or "natural selection" become intelligible, and terms such as "adaptation" and "fitness" should be understood. Oversimplifications, such as that of attributing to the adaptation of an organism the fact of "survival" instead of "probability of survival", have been posited against the theory. "Fitness", as Ghiselin remarks, is a physiological concept used as a tool for accomplishing a particular task. Different contexts may produce different levels of efficiency, as one can see when one considers their function within the hypothetical ("if") system. If the premises hold true, and unknown factors do not interfere, it follows deductively that evolution (by means of Natural selection) must occur.

Based on his analysis of the structure of the general argument and its empirical support, Ghiselin answers the tautology problem. Ghiselin distinguishes between explaining natural selection as the conclusion of a deductive argument, and justifying its explanatory power for the natural phenomena it is supposed to explain. He believes that the tautology problem and the apparent tautological character attributed to "natural selection" (and, on occasion, to expressions such as "struggle for existence") result from a misunderstanding caused by the rigor of the argument. In scientific theories, tautologies are at the deductive core of the argument. However, the truth of the hypotheses is justified not on the basis of their tautological elements, but by the ability of the system to generate true predictions about the material universe.

In fact, in the Conclusion of the *Origin*, Darwin says: "It can hardly be supposed that a false theory would explain, in so satisfactory a manner as does the theory of natural selection, the several large classes of facts above specified". The emphasis on the explanatory power of the theory is also shown in Darwin's correspondence, as in his letter to George Bentham of May 22, 1863, where he says that the belief in natural selection should be chiefly based on its power to connect a large number of facts under an intelligible view such as this. However, the importance of the possibility of falsification in Darwin's argument is controversial. Although Darwin proposes certain conditions for falsification (such as when he says that if it were proved that a variation had been accumulated in one species just for the good of another, his theory would be fatally undermined), such conditions could never, in fact, be obtained.

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Biographical Sketch

Prof. Dr. Regner born in Porto Alegre, in 1947. MA in Philosophy from the Pontifícia Universidade Católica do Rio Grande do Sul, 1977. PhD in Education from the Universidade Federal do Rio Grande do Sul, 1995.

She has been Visiting Professor in the Program in History and Philosophy of Science, at Stanford University, 2001. Currently, she is Full Professor of Philosophy in the Graduate Program in Philosophy at the Universidade do Vale do Rio dos Sinos (UNISINOS), in Southern Brazil. Her research and teaching interests have been focused on theory of argumentation as well as on the epistemological, metaphysical and methodological aspects of the Darwinian theory of Natural Selection. Her published work includes several articles, book chapters, and the book *Charles Darwin - Notas de viagem: a tessitura social no pensamento de um naturalista*, Porto Alegre: EST, 1988, in which she translates into Portuguese the passages on social and political phenomena from Darwin's diary on the Beagle, and analyzes the contribution of social, political, and metaphysical elements to Darwin's later theory of natural selection. At present, she is finishing a book on the reconstruction of Darwin's arguments in the *Origin of Species*, in order to see the innovative argumentative strategies he employs and his new view about rationality.