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On the causal efficacy of natural selection: A response to Richards' critique of the standard interpretation



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ABSTRACT

Given the amount of literature devoted to the reasoning used in Darwin's *Origin of Species*, an interpretation seeking to revise the standard take on Darwin's methodology is unexpected. Yet, Richards (1997, 1998, 2005) challenges the view that Darwin drew an analogy in the *Origin* on the grounds that such a strategy could not support the possibility of a new species emerging. I suggest, however, that how one interprets causal efficacy is intimately connected with Darwin's use of analogy. A more robust conception of natural selection, as found in the *Origin*, supports the standard interpretation, significantly weakening Richards' charge of a paradox.

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1. Challenging the standard interpretation of the *Origin*

Since its publication, *On the Origin of Species* has been the subject of numerous debates, and one such debate examines the role of the analogy Darwin draws between artificial selection (the domestication and breeding of animals and plants) and natural selection (his proposed mechanism for evolution).¹ According to what is often thought to be the standard interpretation, Darwin relies on an analogy between artificial and natural selection as argumentative support for the emergence of new species in nature.² Recently, Richard A. Richards (1997, 1998, 2005) challenged the standard interpretation, claiming that Darwin did not draw such an analogy and, if he had, such a strategy could not support the mutability of species.³ Instead, Richards contends that the analogy supports the opposite of evolution: the immutability of species. Citing examples from the opponents of evolution, and even Darwin himself, Richards claims that the standard interpretation, which

supports relying on an inference previously used to demonstrate the immutability of species, results in a paradox or puzzle (Richards, 1997, p. 75; 2005, pp. 209–213). In this paper, I outline the standard interpretation of the analogy in the *Origin* and detail Richards' objections to it. Although Richards provides examples where he believes the standard interpretation fails, I maintain that a more complete reading of the *Origin*, coupled with a revised formulation of causal efficacy, mitigates his objections.

Of course, there is more at stake in this particular debate than the correct interpretation of a highly influential, scientific work. As an exemplar of analogical reasoning in science, whether Darwin relies on an analogy to support his theory or whether it functions solely as a heuristic device affects normative accounts of scientific practice, particularly as regards the different uses of analogy in scientific reasoning. If the standard interpretation is correct, and Darwin does indeed provide a classic example of analogical reasoning, then what we know about the critique of the *Origin* can be

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¹ Hereafter, I refer to the work as the *Origin*.

² Richards (2005) refers to this view as "the standard interpretation of Darwin's argument" (Richards, 2005, p. 207). For this paper, I preserve his terminology.

³ Richards allows for the use of an analogy between artificial and natural selection, but it is only used heuristically, "intend[ing] to assist in understanding how evolutionary principles and processes might work, how these principles and concepts are related, and how evolutionary theory might be extended" (Richards, 2005, p. 224). Richards does not believe Darwin used the analogy with artificial selection to posit a similar process in nature.

brought to bear on questions regarding the social epistemology of scientific practice, notably in the areas linked with the practice of models, such as knowledge production and experimental design. While these points cannot be adequately argued for here, I conclude by offering a sketch for future research.

2. The standard interpretation of Darwin's analogy in the *Origin*

The amount of literature addressing Darwin's use of analogy in the *Origin* is extensive with topics ranging from methodological concerns to the relatively recent debates over the degree that analogy supports Darwin's theory of evolution.⁴ Until Richards' challenge, questions regarding the analogy focused on the role it plays in the *Origin*, such as whether it functions solely as an independent inference or is part of a larger argument. In this section, I present the standard interpretation, drawing from an account offered by Doren Recker.⁵ For Recker, the overall structure of the *Origin* is comprised of three separate "argument strategies" supporting the "probable 'causal efficacy' of natural selection" (Recker, 1987, p. 165). These three strategies are located separately within the *Origin*; however, I will limit my discussion to the parts of the text believed to be evidence of Darwin's analogy (Recker, 1987, p. 165).

According to the standard interpretation, the claim that natural selection is causally efficacious results from an argument that claims natural selection is a likely agent for phenotypical change in organisms given its similarities with another agent for change—artificial selection (Recker, 1987, p. 165). Citing the similarities between artificial and natural selection appearing in Chapters I–III, proponents of the standard interpretation claim that Darwin establishes an analogy between the two processes (Recker, 1987, p. 166).⁶ In light of these similarities, Recker calls attention to Darwin's reasoning in Chapter IV,

Can the principle of selection, which we have seen is so potent in the hands of man, apply in nature? I think we shall see that it can act most effectually. Let it be borne in mind in what an endless number of strange peculiarities our domestic productions, and in a lesser degree, those under nature, vary, and how strong the hereditary tendency is. Under domestication, it may be truly said that the whole organisation becomes in some degree plastic. Let it be borne in mind how infinitely complex and close-fitting are the mutual relations of all organic beings to each other and to their physical conditions of life. Can it, then, be thought improbable, seeing that variations useful in some way to each being in the great and complex battle of life, should sometimes occur in the course of thousands of generations? If such do occur, can we doubt (remembering that many more individuals are born than possibly survive) that individuals having any advantage, however slight, over others, would have the best

chance of surviving and procreating their kind? On the other hand, we may feel sure that any variation in the least degree injurious would be rigidly destroyed. This preservation of favourable variations and the rejection of injurious variations, I call natural selection. (Darwin, 1859, pp. 80–81)

Recker asserts that there are three appeals to artificial selection made by Darwin in the above passage (Recker, 1987, p. 166). The first is Darwin's claim that "artificial selection is *known* to be potent in accumulating variations in a definite direction in domestic cases," asking whether some similar process is present in nature (Recker, 1987, p. 166). This first appeal signals Darwin's intention to draw an analogy, implying the causal efficacy of natural selection arises from the similarities between it and artificial selection (Recker, 1987, p. 166).

The second appeal exists in Darwin's claim that the "organization becomes in some degree plastic" in cases of domestic breeding (Darwin, 1859, p. 80). What Darwin means by organization is the sum total of an organism's traits. For example, the organization of a domestic sheep includes the type of wool, structure of limbs, and any trait that could be modified as a result of mating two sheep. Darwin asserts that changes to an organism's observable traits (phenotypic change) occur in artificial selection **and** that this process takes place in nature as well because all living organisms are capable of change (Recker, 1987, p. 166).⁷

The final appeal appears where Darwin asks "Can it, then, be thought improbable, seeing that variations useful in some way to each being in the great and complex battle of life, should sometimes occur in the course of thousands of generations?" (Darwin, 1859, p. 80). This particular question emphasizes a similarity between the processes of selection in domestic cases and those occurring in nature: the accumulation of traits. For example, domestic stock, at the hands of breeders, has changed drastically from the original stock.⁸ Animals with the best meat or fiber (given whatever the breeder's aim) are preserved while animals without the particular trait are culled from the flock. Over time, this creates great differences between animals. An analogous process occurs in nature; individuals without a specific, beneficial trait find it harder to compete with the other advantaged individuals, and ultimately become extinct.

These three appeals to domestic cases—the process of selection, that changes are inherited, and that some of these changes contribute to an individual's survival/reproduction—are best viewed "as presenting and supporting the analogical *goal* of this argument, and to view the entire argument as supporting the causal efficacy of natural selection by appealing to *known* causal efficacy of artificial selection" (Recker, 1987, p. 166). In other words, these three appeals form the analogy between artificial and natural selection and as a result of this analogy, what we know

⁴ Previous literature includes Michael Ruse (1971, 1973, 1975, 1979), M. J. S. Hodge (1977, 1992, 2012, 2013), L. T. Evans (1984), Robert Young (1985, 1993), Ken Waters (1985, 1986), Doren Recker (1987), Ernst Mayr (1991), Daniel Dennett (1995), S. Schweber (1977), S. G. Sterrett (2002), and P. Gildenhuys (2004).

⁵ I do this for two reasons: first, Recker's account does not attempt to apply a modern conception of scientific methodology to the *Origin* and second, Richards singles out the views of Recker, especially Recker's claim that Darwin draws an analogy between artificial and natural selection because it would be "causally efficacious" to do so (Recker, p. 165).

⁶ For example, Recker claims "The first and third chapters appeal to the power of selection, both artificial and natural, the latter being even more powerful than the former since there are important limitations on human selection, and nature has vast amounts of time in which to 'act', etc." (Recker, 1987, p. 166). As Recker points out, at the end of Chapter I, Darwin lists features of artificial selection that would be similar to those features found in nature (Recker, 1987, p. 166). These are "a high degree of variability," "a large number of individuals," and "preventing crosses" (Darwin, 1859, pp. 41–42). These features of artificial selection are listed in Chapter IV as features of natural selection (Recker, 1987, p. 167). For example, in the summary of Chapter IV Darwin states

If during the long course of ages and under varying conditions of life, organic beings vary at all in the several parts of their organization, and I think this cannot be disputed; if there be, owing to the high geometrical powers of increase of each species, at some age, season, or year, a severe struggle for life, and this certainly cannot be disputed; then considering the infinite complexity of the relations of all organic beings to each other and to their conditions of existence, causing an infinite diversity in structure, constitution, and habits, to be advantageous to them, I think it would be a most extraordinary fact if no variation ever had occurred useful to each being's own welfare, in the same way as so many variations have occurred useful to man. But if variations useful to any organic being 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 they will tend to produce offspring similarly characterized.

(Darwin, 1859, pp. 126–127)

⁷ Throughout the paper, I use phenotypic change to refer to the change in an individual's observable traits; although this term was not used by Darwin.

⁸ As support, Darwin points to the different breeds of the domestic pigeon (Darwin, 1859, pp. 20–29).

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