

Research Essay

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Victor Elgersma

v.j.b.elgersma@students.uu.nl

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Key biological facts

- Species are not specially endowed with sterility of first crosses to keep them “separate” from each other.
- Essentialism vs Nominalism.

Abstract

An epistemic practice is the way a specific community goes about making and justifying knowledge. This essay will analyse Charles Darwin’s *On The Origin of Species By Means of Natural Selection* (1859) and Richard Dawkins’ *The Selfish Gene* (1976), finding what they each reveal about how epistemic practices in biology have evolved between the late nineteenth and early twentieth centuries. We focus particularly on the changing roles of personification.

Introduction

John V. Pickstone has typified three primary ways of knowing: *natural history* (the describing and classifying of things) *analysis* (breaking them down into various elements) and *experimentation* (controlling phenomena and systematically creating novelties) [1]. He to use this typology to link social and political histories with ‘dominant’ or ‘recessive’ ways of knowing. By showing how technological developments made their way into scientific practice, the book closes the gap between history of ways of knowing (science) and histories of ways of doing (technology) [1].

The eighteenth century biology was the age of classification [1, p. 30], with an experimental streak ascendant in the realm of commercial technology. Pickstone draws a connection between the breeding of pedigree animals for money and the emergence of Darwinian selection:

In Britain from 1750, cattle and sheep were changed radically as breeders sought marketable characteristics and faster growth. Sheep, Bakewell said, were machines for turning grass into money; they could be redesigned to do so more efficiently. And that new mutability of domestic animals was well known both to Charles Darwin and to his contemporary, Gregor Mendel, the Moravian monk and science teacher who in the 1860s discovered mathematical ratios in the inheritance of plant characteristics. Indeed, both the theory of evolution by natural selection and Mendel’s work on inheritance can be shown to have built on this shift in breeding technology (Desmond and Moore, 1992; Orel, 1984).

— Pickstone [1]

Indeed, Darwin was a keen breeder of domestic pigeons, and a member of two (!) of the London Pigeon Clubs [2, p. 19].

In *Why Classify?*, Richards points out that the view of Darwin’s unfinished *Natural Selection* seemed to be at odds with philosophers in the mid-twentieth century on their view of species. Mid-twentieth philosophers saw species as natural kinds, or categories that “cut nature at the joints”, as it were (based on a realist ontology in which nature is really made up of various “stuff” put together somehow - a *natural kind* is a category that maps cleanly onto this “stuff”) [3]. But there is no need, as Richards does, to dig through Darwin’s unfinished manuscripts to understand what he thought

about species. It is clear as day in *Origin*: “there is no fundamental distinction between species and varieties”.

was at odds with pointed out, Darwin had a conventional view of species. Pickstone argues that it was the influence of experimentation and a shift from the ‘natural history’ to ‘analytica’ way of knowing that meant that species lost some of their ‘given-ness’ [1, p. 102]. Indeed, Darwin writes that it was general knowledge that species have been endowed with the property of offspring between different species being sterile:

The view generally entertained by naturalists is that species, when intercrossed, have been specially endowed with the quality of sterility, in order to prevent the confusion of all organic forms.

– [2, p. 182]

The sterility of hybrids is especially difficult for natural selection to explain, because the sterility of an organism cannot possibly bring it any advantages to its survival and reproduction, which is a core mechanism of the theory. Darwin cites experiments done by

Citing evidence from Kolreuter and Gartner, he concludes that the “two most careful experimentalists who have ever lived, have come to diametrically opposite conclusions in [classifying species by their sterility]”, Darwin concludes that:

There is no more reason to think that species have been specially endowed with various degrees of sterility to prevent them crossing and blending in nature, than to think that trees have been specially endowed with various and somewhat analogous degrees of difficulty in being grafted together in order to prevent them becoming inarched in our forests.

This challenge to species *essentialism* is indeed a focus on a reinterpretation of existing experiments in plant hybridization. But Darwin also draws on the *natural history* way of knowing by citing that in pure observational-classificatory terms (i.e without recourse to experiment), naturalists disagree over whether to use the word “species” or “varieties” in certain plants:

“Mr. H. C. Watson has marked for me in the well-sifted London Catalogue of Plants (4th edition) 63 plants which are therein ranked as species, but which he considers as so closely allied to other species as to be of doubtful value: these 63 reputed species range on an average over 6.9 of the provinces into which Mr. Watson has divided Great Britain. Now, in this same catalogue, 53 acknowledged varieties are recorded, and these range over 77 provinces; whereas the species to which these varieties belong range over 143 provinces. So that the acknowledged varieties have very nearly the same restricted average range, as have those very closely allied forms, marked for me by Mr. Watson as doubtful species, but which are almost universally ranked by British botanists as true and good species.”

Darwin was mainly trying to destroy essentialism in species. Dawkins was mainly trying to destroy the belief that altruism arises because of animal instincts that evolved because of group selection or the ‘survival value for the species’. For both of them, species was a not a good analytical category.

Finally, Darwin concludes: “the facts briefly given in this chapter do not seem to me opposed to, but even rather to support the view, that there is no fundamental distinction between species and varieties”. Most of these facts are about experimental hybridization, not natural history.

Applying Currie and Levy's typology to the Gartner and Kolreuter hybridization experiments, as shown in Origins Ch8

Dawkins

Griffiths argues that a major shift in animal ethology in the 1970s was a foregrounding of two of Tinbergen's four research questions of animal behavior: (1) causation, (2) survival value, (3) ontogeny, and (4) evolution. It was the domination of the adaptationist programme in English-speaking ethology that put the emphasis on (2) and (4) at the detriment of (1) and (3). The *The Selfish Gene* should be read with this in mind.

- The point of the *The Selfish Gene* is to study the examine the implications of Darwinism for "selfishness and altruism". It is an unfortunate phrase as it cemented the association of human selfishness with the "selfish gene", an issue that Dawkins himself lamented.

Topics I would like to cover

- Different biology practices culminating in Origin vs in SG
- Dawkins explains altruism through kin selection. How does Dawkins do this
- The Eclipse of Darwinism
- What Darwin actually argued and its metaphysical presuppositions / historical context and roots
- What Dawkins actually argued and its metaphysical / historical context
- Problem of evil

Similarity & Contrast

- Similarity
 - Both have been described as expounding a *cold, bleak message*
 - Both have been accused of having bleak social and philosophical implications.
- Contrasts
 - Darwin believed that most amount of competition is between similar organisms, whereas Dawkins believes in kinship-inspired altruism - this is quite a contrast
 - Darwin had the problem of dilution of inheritance, Dawkins doesn't have that by switching the unit of selection to the organism
- From reproduction to replication

Problem of Evil?

- Asa Gray considered natural selection to be the main mechanism of evolution and sought to reconcile it with natural theology. He proposed that natural selection could be a mechanism in which the problem of evil of suffering produced the greater good of adaptation.¹

Introduction: Dawkins & Darwin Deep Dive

If only because they are widely considered the most influential biology books of the 19th and 20th centuries, respectively, a deep dive into Charles Darwin's *On The Origin of Species By Means of Natural Selection (1859)* and Richard Dawkins' *The Selfish Gene* seems compelling. The essay will further analyze what the two authors, Dawkins and Darwin, reveal about the epistemic practices in biology. We will trace the shift from the organismic theory to the genocentric theory of evolution as a way of "knowing" biology. We will be discussing the shift that biology took from having the organism as the primary study to having the gene as the object of primary study (where the organism is relegated to a 'vehicle').

¹https://en.wikipedia.org/wiki/The_eclipse_of_Darwinism

I will argue that the shift from *Origin* to *Selfish Gene* represents a shift in the epistemic culture of biology, a shift from a Natural History² to ones focused on mathematics³ Information Theory.

Explanations for Altruism post-Darwin

Before Darwin, altruism in humans did not need explaining. Dawkins points out that “anything that evolved by natural selection is selfish” [4, p. 5]. So how is it explained? Many people sought to explain it in terms of “the good of the species” but this did not work because a single selfish individual would dominate a group of altruists. Dawkins explains that a gene-centered view of evolution explains altruism as a limited form of cooperation among organisms, for the sake of the survival of the genes - kin selection and reciprocal altruism. So he uses *gene selfishness* to explain altruism and selfishness at the level of organisms.

Personification as epistemic practice (Darwin and Dawkins)

In their writings, both Darwin and Dawkins make use of personification - the ascribing of intelligence and motivation to objects that don't have them. I argue that these kinds of personification should be viewed as an epistemic practice responding to the changing demands of the field of biology between the 19th and the 20th centuries. Whereas Darwin appears to attribute intelligence and choice to *Nature*, Dawkins does the same to genes and *organisms*. Both Darwin and Dawkins use personification as both a didactic tool and a heuristic for professional biologists, that is to say, an epistemic practice. However, they also both stop well short of implying that this personification should be taken literally, thus defending this personification as an epistemic tool from literal-minded critics.

In her introduction to the 2009 reprint of Darwin's *Origin of Species*, Gillian Beer argues that Darwin *needs* a strongly personified view of Nature, going beyond a metaphorical one [5]. This is evident, for example, in the following passage:

as man can certainly produce great results by adding up in any given direction mere individual differences, so could Nature, but far more easily, from having incomparably longer time at her disposal

— Darwin, *Origin of Species*

Indeed, this passage appears to endow Nature with the agency to “produce great results”. However, Beer doesn't make it clear what she means by “needs”. If she means that Darwin's *theory* needs a strong personification of Nature, that is to say - that *Origin of Species* could not make its argument cogently *without* resorting to the personification of Nature as an *explanans*, I strongly disagree. Instead, Darwin's use of the metaphor as such is perfectly justified by his own explanation for it:

So again it is difficult to avoid personifying the word Nature; but I mean by Nature, only the aggregate action and product of many natural laws, and by laws the sequence of events as ascertained by us.

— Darwin, *Origin of Species*

In other words, the use of a personified *Nature* is not essential to the argument for natural selection, but serves merely as a useful shorthand for the many natural laws which lead to the survival of some and death of other species. This begs the question, if Darwin knew that the personification of

²See ways of knowing - maybe I can connect this to the 'natural-historical' way in the sense he means this

³Mention Hamilton

Nature was a merely a convenient metaphor, why was he not more careful about avoiding passages like these in *Origin*:

Nature acts uniformly and slowly during vast periods of time on the whole organisation, in any way which may be for each creature's own good

— Darwin, *Origin of Species*

I can think of two reasons. First, as mentioned - it is a useful shortcut and thus a good didactic tool. A central part of the *Origin of Species* is to draw analogies between artificial selection and natural selection. By comparing Nature to a human breeder (“as man can certainly produce great results... so could Nature”), he uses the familiar to make the radical intelligible.

But there is another, perhaps more important reason why Darwin personifies *Nature* despite the risks of being taken literally. To understand that, we must turn to the social context in which Darwin was working. We have to understand that Darwin was addressing a broadly educated audience and writing as a popular science writer in addition to an accredited naturalist: Parts of *Origin of Species* have the lyricism that made *Voyages of the Beagle* of a huge success, whereas others read more like his dense technical writing in **The Structure and Distribution of Coral Reefs** or the **Study of the Cirripedia**. He was thus ready to be met with moral as well as biological objections. In particular, the objection that Darwin's ideas were fundamentally more bleak than natural theology, which viewed “all manifestations of nature” as “aspects of a relationship between God and Man” [5]. Personifying Nature, therefore, helped soften the moral blow by maintaining the awesomeness of creation - replacing a real, active God with a personified, metaphorical Nature.

However, if Gillian Beer uses “needs” to mean that Darwin's everyday practice as a biologist led him to personify Nature, then I agree. In this case, we can view the personification of Nature as an epistemic practice typical of 19th century biology which has fallen out of favour (giving a way to the personification of genes and organisms in ways I shall detail below). Darwin undoubtedly used the personification of Nature in this latter way when formulating and refining his theory of Natural Selection. This is because the parallels that he saw between *natural selection* and *artificial selection* aren't merely analogies he uses to drive the point home to his Victorian audience, but it is how *he himself stumbled across the theory* (if we believe Darwin, and we have no reason to disbelieve his words on this point).

While Nature is elevated with metaphorical agencies, Darwin's organisms stay blissfully ignorant of their role in evolutionary change. We will see that the view presented by Dawkins is quite different.

By 1976, biologists no longer needed to “soften the moral blow” of natural selection, which was generally accepted as the main mechanism that explains the evolution of species. Instead, they needed tools to navigate the complex, data- mathematics, and computation-heavy practice of the Modern Synthesis of biology. Personification was one of these tools. Thus, Dawkins states that “natural selection for selfish genes tends to favour cooperation among genes”, ascribing the (anthropomorphic) quality of cooperation to genes. Dawkins responded to accusations of his anthropomorphizing genes by arguing that “no sane person thinks DNA molecules have conscious personalities”. He defends his hero D.W Hamilton's decision to “attribute to the genes, temporarily, intelligence and a certain freedom of choice” in explaining why the sterility of worker ants did not provide problems with evolution [6]. Moreover, he argues that personification of this kind is not “just a quaint didactic device” - in “Darwinian calculations of altruism and selfishness [...] it is very easy to get the wrong answer. Personifying genes, [...] often turns out to be the shortest route to rescuing a Darwinian theorist drowning in muddle”. Thus, the *personification of genes* becomes an epistemic practice to short-cut the complex mathematics involved in the computation of relative

gene frequencies. But Dawkins does not just personify genes; organisms get the same treatment. On page 168 of the *Selfish Gene* we find him arguing :

As soon as a runt becomes so small and weak that his expectation of life is reduced to the point where benefit to him due to parental investment is less than half the benefit that the same investment could potentially confer on the other babies, the run should die gracefully and willingly. He can benefit his genes most by doing so.

— *Selfish Gene*, p168

Here, Dawkins is not literally describing the internal mental state of the runt. Instead, a gene-centric theory of evolution implies that animals have been loaded with instincts which function *as-if* they were constantly maximising their chance of passing on their genes. Thus, the *personification of the organism* acts as another epistemic short-cut (just like the personification of the gene), allowing the biologist to quickly arrive results that would be impossibly laborious and error-prone to achieve with mathematical modelling. The runt's personification is really a product of the genes that it makes up, which themselves are personified, as we saw:

A gene that gives the [runt] the instruction, “Body, if you are very much smaller than your litter-mates, give up the struggle and die” could be successful in the gene pool, because it has a 50 per cent chance of being in the body of each brother and sister saved.

— *Selfish Gene*, p168

So, both Darwin and Dawkins use personification both as an epistemic practice as biologists and as a didactic tool for their readers. Whereas Darwin was carefully anticipating the perceived incompatibility of evolution and Victorian Morality, Dawkins does not have these sensitivities to modern-day moral objections to Darwinism: “If something is true, no amount of wishful thinking can undo it” [4].

Nevertheless, Dawkins writes that the fact⁴ that genes have survived for billions of years means they are selfish, and the fact that genes are selfish means organisms are selfish too, most of the time (with some limited altruism when it aids the survival of the genes). Whereas for Darwin, natural selection places agency on the divine Nature, for Dawkins “anything that has evolved by natural selection is selfish” [4, p. 5]

In Defense of *Origin of Species* as a popular science book

At first it may be objected that we are unfairly comparing an original contribution to science (*Origin*), with ‘merely’ a popular, though influential, science book (*Selfish Gene*). But this would be a misunderstanding of both books: Despite revolutionizing the field, Darwin's *Origin* had as a target audience of both expert naturalists and a broad, educated public. As Gillian Beer writes, Darwin wanted his ideas to be “available simultaneously to Darwin's fellow-workers in science and to any educated person” [5, p. viii]. Similarly, Dawkin's *Selfish Gene* did not merely try to popularize ideas already swirling around in biology circles. He clearly targeted.

Miscellaneous notes on Darwin's origin of species

Darwin's *Origin of Species* is a work full of contradictions. It written for non-specialist readers and yet had a profound impact on biology. Although its main purpose was to explain the mechanism of natural selection and argue for its centrality in evolutionary change, the main impact of the book

⁴Using the analogy of Chicago gangsters

was to increase acceptance of species transmutation - the centrality of natural selection remained a minority view in biology until the 1930s.

Darwin's theory was pithily captured in the "Instinct" chapter

Darwin's book proposes "one general law, leading to the advancement of all organic beings", which he called "natural selection", pithily summarized as "multiply, vary, let the strongest⁵ live and the weakest die." [2, p181, ch7]. It is commonly argued Dawkins applied this logic but substituted the *organism* for the *gene*. However, as Dawkins clarifies in the Introduction to the 30th anniversary edition of the *Selfish Gene*: "there are two kinds of units of natural selection, and there is no dispute between them. The gene is the unit in the sense of a replicator. The organism is the unit in the sense of the vehicle. Both are important."

Introducing the Selfish Gene

The *Selfish Gene* can be understood as the most successful popular account of the Modern Evolutionary Synthesis of the 1930s and 1950s.

Naming Woes

Darwin does not need a strongly personified Nature for any explanatory reasons, but he does need them in a (failed) attempt to quell public backlash

Commentators mistake the centrality of symbiosis to Darwin's view of life

'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'

Bibliography

- [1] J. V. Pickstone, *Ways of knowing: a new history of science, technology, and medicine*, Nachdr. Chicago, Ill: Univ. of Chicago Press, 2004.
- [2] C. Darwin, *On the origin of species*. in Oxford World's Classics. London, England: Oxford University Press, 2008.
- [3] R. A. Richards, *Biological Classification: A Philosophical Introduction*, 1st ed. Cambridge University Press, 2016. doi: 10.1017/CBO9781107588233.
- [4] R. Dawkins, *The selfish gene*, 40th anniversary edition. in Oxford landmark science. Oxford, United Kingdom: Oxford University Press, 2016.
- [5] G. Beer, "Introduction," in *On the Origin of Species*, Revised., G. Beer, Ed., in Oxford World's Classics., Oxford University Press, 2009.
- [6] W. D. Hamilton, "Altruism and Related Phenomena, Mainly in Social Insects," *Annual Review of Ecology and Systematics*, vol. 3, no. 1, pp. 193–232, Nov. 1972, doi: 10.1146/annurev.es.03.110172.001205.

⁵As the rest of Darwin's writings make clear, *strongest* should be taken to mean *best adapted to its environment*, which could mean the *most camouflaged* or the *most cooperative* depending on the situation!