Endeavour Vol. 38 No. 3–4

Laws of variation: Darwin's failed Newtonian program?

Thierry Hoquet

University Lyon 3, France

Lamarckian ideas spread all over Europe but were generally scorned by mainstream academic circles.[1] Working within this hostile context, Darwin stuck carefully to a Newtonian methodology in order to convince his colleagues that his methods were sound and that he was not another German romantic Naturphilosoph, or just an enthusiast of the *Vestiges of the Natural History of Creation*. In this way, Darwin's methodological concerns were fundamental in the framing of his theory: they pervade the basic structure of his 1859 masterpiece *On the Origin of species* so as to secure the epistemological triumph of natural selection. However, the transformation of species was not the only question gnawing at European naturalists and breeders. They were all very much concerned with the issue of the origin of variations, as is evinced by the works of Augustin Sageret (1763–1851) or Louis de Vilmorin (1816–1860) among others.[2] I claim in this paper that there was a second purpose to Darwin's research. Darwin wanted to contribute to solving not only the 'mystery of mysteries' of the origin of species but also the riddle of the well-worn question behind the origin and laws of variations. In order to fulfil this aim, he also used Newtonian principles. Indeed, under the umbrella-term 'laws of variation,' several issues are entangled: whether any particular variation has a (yet unknown) cause or not; whether it has been providentially designed or not; whether variation is directed or not; whether directedness in variation has an incident over the power of natural selection. Following the thread of variations, one understands the potential conflict between Darwin's twofold commitment towards natural selection and variation.

In this paper, I argue that when Darwin speaks of a '*vera causa*' he does not exclusively mean 'natural selection' but refers also to other issues: especially modification, variation and generation versus creations and miracles. This view slackens the idea that the *Origin* is just 'one long argument': in fact Darwin was striving to solve various questions in the *Origin*, as will be clearly displayed by the analysis of chapter 5 of the *Origin*. Moreover, I will argue that Darwin followed a somewhat Baconian program when studying the laws of variations: *viz.* induction from large classes of facts. However, because of various conceptual intricacies, this second program dramatically failed and the laws of variation were to remain in the dark.

Darwin and the *vera causa*

Darwin's contribution to the 'second scientific revolution' is generally linked to his contribution towards solving the riddle of the origin of species by advancing natural selection as a mechanism for it. Darwin's methodological principles are often related to the Baconian-Newtonian complex, playing a key role in the discovery of the paramount power of natural selection as the main mechanical means he suggested for the modification of species. What Darwin owes to Newton is what has been called 'the *vera causa* principle.'[3] In Newton's *Principia mathematica*, the first rule for the study of natural philosophy is: 'No more causes of natural things should be admitted than are both true and sufficient to explain their phenomena.'[4] The *vera causa* tradition was transmitted to Darwin from Newton through the work of the astronomer John Herschel. For Herschel, a good criterion that the *vera causa* has been found is when one has discovered an 'analogy of two phenomena [that are] very close and striking': 'while, at the same time, the cause of one is very obvious, it becomes scarcely possible to refuse to admit the action of an analogous cause in the other, though not so obvious in itself.'[5] As applied by Herschel, the *vera causa* principle amounts to a form of analogical reasoning, starting from what we know well. In the *Origin*, artificial selection and the experience of breeders with domestic animals and plants is the sound analogical basis upon which natural selection rests to become a *vera causa* for the transformation of species.

Another interpretation of the *vera causa* principle lies in the concept of 'consilience of inductions' developed, from Baconian principles, by the philosopher of science

Corresponding author: Hoquet, T. (thierry.hoquet@univ-lyon3.fr).

[1] Pietro Corsi, *The age of Lamarck: evolutionary theories in France, 1790–1830*, translated by Jonathan Mandelbaum (Berkeley, 1988); James A. Secord, *Victorian sensation: the extraordinary publication, reception, and secret authorship of* Vestiges of the natural history of creation (Chicago, 2000).

[2] Augustin Sageret, *Pomologie physiologique ou traité du perfectionnement de la fructification* (Paris, 1830); Louis de Vilmorin, «Ajonc sans épines. Note sur un projet d'expérience ayant pour but de créer une race d'ajonc sans épines se reproduisant de graines», *Revue Horticole*, 4th series, vol. 1 (1852), 22–29.

Available online 7 November 2014

[3] See especially Vincent Carl Kavaloski, *The Vera Causa Principle: a historico-philosophical study of a metatheoretical concept from Newton through Darwin*, PhD, June 1974, University of Chicago.

[4] Isaac Newton, *The Principia. Mathematical principles of natural philosophy*, trans. by I. Bernard Cohen and Anne Whitman, (Berkeley, 1999; first published in Latin in 1687), 794.

[5] John F. W. Herschel, *Preliminary discourse on the study of natural philosophy* (London, 1830), 149.

  http://dx.doi.org/10.1016/j.endeavour.2014.10.007

William Whewell in his *Philosophy of the inductive sciences* (1840).[6] According to the consilience criterium, the *vera causa* is discovered when various sets of phenomena are brought together and explained from the same principle. Newton's success in astronomy, for instance, is due to his bringing together various classes of facts, such as the motions of the planets, the tides and the falling of heavy bodies like apples and stones, all under the law of attraction. In Darwin's case, the consilience methodology is visible in the structure of the last chapters of the *Origin*: when he explains that natural selection is what accounts for the geographical range of living species, for the distribution of fossilised organisms in paleontological data, or for the classification of species, genera and varieties in present-time systematics.

As Jonathan Hodge has shown,[7] the *vera causa* principle and the methodology of consilience of inductions are useful tools for manifesting the hidden structure of Darwin's 'long argument' in the *Origin*. Darwin successively solves three different puzzles: he shows that natural selection *exists* (chapters 1 to 3), that it is *competent* for accounting for the transformation of species (chapter 4), and finally that it is *actually responsible* for the transformation of species (chapters 6 to 14). In this classical view, the *Origin* develops Darwin's 'one long argument,' which it sees as an argument in favour of the existence, competence and responsibility of natural selection. Some passages of Darwin's correspondence clearly confirm this. Writing to the botanist George Bentham (22 May 1863), Darwin expressed the following grounds for his 'belief in Natural Selection': '(1) On its being a *vera causa*, from the struggle for existence; and the certain geological fact that species do somehow change. (2) From the analogy of change under domestication by man's selection. (3) And chiefly from this view connecting under an intelligible point of view a host of facts.' Such a quote supports both Hodge's claim that Darwin's aim was to reveal natural selection to be a *vera causa*, and Ruse's suggestion that Darwin was also influenced by the Whewellian model of consilience of inductions.

In the *Origin of Species*, Darwin also refers three times to the '*vera causa* principle.' However, those three references are made only in passing and Darwin never makes an explicit case of his trying to show that natural selection is a *vera causa* for the origin of species. The first occurrence of the phrase '*vera causa*' is in chapter 5: Darwin contrasts 'the ordinary view of each species having been independently created' to 'the *vera causa* of community of descent, and a consequent tendency to vary in a like manner.'[8] The second reference to *vera causa* is in chapter 11: Darwin refers to 'the question which has been largely discussed by naturalists, namely, whether species have been created at one or more points of the earth's surface.' Darwin here is in favour of species produced in a single region and then migrating to several distant points. He contrasts 'the *vera causa* of ordinary generation with subsequent migration' and what he calls 'the agency of a miracle.'[9] The last reference to the *vera causa* is in chapter 14 (Recapitulation and Conclusion).[10] According to Darwin, 'several eminent naturalists have of late published their belief that a multitude of reputed species in each genus are not real species; but that other species are real, that is, have been independently created.' Those naturalists have to discriminate between forms which were specially created (hence, true species) and forms which have been produced by variation. Hence, they use double standards: 'they admit variation as a *vera causa* in one case, they arbitrarily reject it in another, without assigning any distinction in the two cases.'

What is striking here is that, in none of these cases, is natural selection invoked as a *vera causa*. Rather, the *vera causa* is community of descent in the first case, generation and migration in the second and variation in the third. In other terms, a careful reading of the *vera causa* theme in the *Origin* reveals a first anomaly of the classical view. Though it is probably correct to read the structure of the argument of the *Origin* as building a case for natural selection, there is however much more to read in Darwin's only, albeit convoluted, argument.

The puzzle of the fifth chapter of the *Origin*

Another anomaly in the classical view is that, within this framework, critics are left clueless as to what to do with one chapter of Darwin's book: the fifth chapter, devoted to the question of the laws of variations. This chapter is especially problematic as it is here that Darwin probably comes closest to Lamarckian ideas. He expresses his strong belief in inheritance of acquired characters and makes various statements on strange laws determining the variations that occur in living organisms. In gathering these phenomena on correlated variations and other possible laws, Darwin was actually searching for a second program, which he hoped to solve with the same set of methodological principles: the puzzle of the laws of variations was as difficult, and as important, to solve as that of descent with modification. Besides, if variation is to be taken seriously, two distinctions have to be made: between variation and natural selection; and between variation and heredity.

Darwin's interest in variation actually exceeds his concern for providing natural selection with a sufficient amount of material. If variation is merely the material to be seized upon by selection, then this claim makes knowledge of the causes of variation unnecessary. However, Darwin followed a theoretical project regarding the laws of variation, as such. Hence, his concern here cannot be restricted to just gathering evidence that a large amount

[6] For a comparison between Herschel and Whewell, see Michael Ruse, *The Darwinian Revolution* (Chicago, 1999; first ed. 1979) and his paper "Darwin's debt to philosophy: an examination of the influence of the philosophical ideas of John F. W. Herschel and William Whewell on the development of Charles Darwin's theory of evolution," *Studies in history and philosophy of science*, 6 (1975), 159–181. On consilience, see Whewell's *Philosophy of the inductive sciences* (London, 1840); and the analyses by Larry Laudan, "William Whewell on the consilience of inductions," *Monist*, 55 (1971), 368–391; Michael Ruse, "The scientific methodology of William Whewell," *Centaurus*, 20 (1976), 227–257.

[7] M.J.S. Hodge, "The structure and strategy of Darwin's 'long argument'," *British Journal for the history of science*, 10 (1977), 237–246; "Darwin's theory and Darwin's argument," in Michael Ruse (ed.), *What the philosophy of biology is. Essays dedicated to David Hull* (Dordrecht-Boston-London, 1989), 163–182; "Natural selection as a causal, empirical and probabilistic theory," *in* L. Krüger, G. Gigerenzer et M.S. Morgan (eds), *The probabilistic revolution*, (Cambridge, MA, 1987), vol. 2, 233–270. These three major contributions are reprinted in *Before and after Darwin. Origins, species, cosmogonies, and ontologies* (Aldershot, UK, 2008).

[8] Darwin, *On the origin of species by means of natural selection* (London, 1859), 159.

[9] Darwin, *Origin*, 352.

[10] Darwin, *Origin*, 482.