

2015

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Recommended Citation

Pence, Charles H., "The Many Chances of Charles Darwin" (2015). *Faculty Publications*. 16.
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Contents lists available at ScienceDirect

Studies in History and Philosophy of Biological and Biomedical Sciences

journal homepage: www.elsevier.com/locate/shpsc

Essay review

The many chances of Charles Darwin

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When citing this paper, please use the full journal title *Studies in History and Philosophy of Biological and Biomedical Sciences*

Darwin's Dice: The Idea of Chance in the Thought of Charles Darwin, Curtis Johnson. Oxford Univ. Press, Oxford & New York (2015). xxxii + 253 pp., Price US\$29.95 hardback, ISBN: 978-0-19-936141-0

1. Introduction

Charles Darwin was, clearly, a man comfortable with epistemic ambiguity. Indeed, one of the most refreshing things about reading the works of Darwin—particularly his reflections in his many and detailed notebooks—is how he is willing to frankly acknowledge his ignorance. Nowhere, arguably, is this evidenced more than in Darwin's discussions of variation. While Darwin was deeply concerned with explaining the way in which variations occurred in animals, as has been expertly argued by both Hodge and Sloan (Hodge, 1985; Sloan, 1986), his empirical success was limited, and evolutionary theory would await the unification of Mendelian genetics with Darwin's work in the early 20th century (and the characterization of DNA beyond it) before the problem would fully be resolved.

This left Darwin in something of an unenviable position. He knew that explaining the causes of the variations that produced the history of life would be vital to, in particular, his critics' acceptance of his theory, yet he had precious little that he could concretely say about them. In no small part, then, the period dubbed the “eclipse of Darwinism” by Bowler (1992) can be interpreted as being driven by the inability of the Darwinian theory of the day to offer a coherent account of variation.

Despite this minimal historical sketch being nearly common knowledge at this point, it can still offer us a vast array of interesting historical questions to be analyzed. One, in particular, will be the focus here. How did Darwin deal, rhetorically, with the fact that

he could not offer an ironclad, empirically supported theory of variation?

It is clear that the answer to this question has something to do with Darwin's use of chance. After all, we now refer to one of the central principles underlying his insight about heritable variation as “random variation,” and much of this usage traces directly back to Darwin's own frequent references to chance in the discussion of variation. Famously, of course (and right at the beginning of a chapter of the *Origin of species*, no less), Darwin explicitly asserted that such references point out only our lack of understanding of the relevant causes at work:

I have hitherto sometimes spoken as if the variations – so common and multiform in organic beings under domestication, and in a lesser degree in those in a state of nature – had been due to chance. This, of course, is a wholly incorrect expression, but it serves to acknowledge plainly our ignorance of the cause of each particular variation. (Darwin, 1859, p. 131)

But the simplicity of this disavowal (and the implication, thereby, that there exists only one notion of “chance” in Darwin—chance as ignorance of true causes) masks the depth and sophistication of Darwin's thought on the matter. As has been argued by numerous commentators (Beatty, 2006; Depew & Weber, 1995; Hodge, 1987; Hull, 1973; Pence, 2015), chance is one of the most subtle and interesting topics in Darwin's thought, and studying it can shed light on the way in which Darwin understood areas of biology as disparate as the causal structure of natural selection and the morphology of orchids.

One fact must be acknowledged immediately—when Darwin uses the word “chance,” he refers to a bewilderingly large variety of concepts. For example, in my own work on Darwin's use of chance, I note that Darwin moves back and forth among chance as the absence of design, chance as something like the law of large numbers (about which more later), and (most often) chance as subjective ignorance of the true deterministic laws, leading as a consequence to unpredictability (Pence, 2015, pp. 50–51). Beatty (2006, p. 630) emphasizes in addition to these the sense in

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which, by extension, divergences themselves can be said to be “chancy” (i.e., unpredictable) for Darwin. Several other authors (Lennox, 2010; Noguera-Solano, 2013) have also more fully elucidated the role of chance as opposed to design (or, to borrow Noguera-Solano’s apt term, “pre-design”) in variation. All our analyses of Darwin’s use of chance, then, must figure out how to come to terms with this thoroughgoing polysemy.

Into this tangled fold enters Curtis Johnson’s new book, *Darwin’s dice: The idea of chance in the thought of Charles Darwin*. While I think there is much to recommend the detailed analysis that is found in Johnson’s book, I have genuine reservations about its central theses. Happily, however—and for precisely the reasons that I noted above—exploring my misgivings illuminates many of the most exciting and interesting areas of Darwin’s thought. In spite of our disagreements, I believe that Johnson has carefully and clearly pointed out a wealth of information, much of it important to clarifying our understanding of Darwin.

2. A wide-searching spotlight

I should begin by noting the impressive breadth of Johnson’s work, which is undoubtedly its most outstanding feature. Johnson works through Darwin’s discussion of chance as it applies to a large array of topics—the chance transport of organisms to new locations, chance as related to the causes of variations, chance’s role in the anthropomorphized, agential version of natural selection (and the changes in this position over time), the focal “architect” metaphor found in the *Descent of man*, Darwin’s evolving relationship to the “Lamarckian” influences of use and disuse, and finally his thoughts on the relationship between chance and human free will and morality. A synthetic account of all these strands had yet to be attempted, making much in Johnson’s book rewarding even for those who have already read fairly extensively in Darwin studies.

To single out a few of these themes, I find particularly intriguing Johnson’s treatment of “chance transport”—the facilitation of the distribution of species by carriage across water to islands. Johnson emphasizes and details the role of the coevolution of adaptations for chance transport as a place where adaptation and chance play a peculiar and interesting role for Darwin. As far as I know, the question of chance transport has yet to receive any extensive discussion in the literature, and this section is both welcome and novel.

Further, Johnson both closely tracks and evaluates hypotheses concerning the development of Darwin’s thought over time. He is a keen reader of the changes that occurred from Darwin’s journey aboard the H.M.S. Beagle, through his various private transmutation notebooks, the various editions of the *Origin of species*, and his later works including the *Descent of man* and *Variations of plants and animals under domestication*. Some of the material Johnson covers, such as Darwin’s “Old and Useless Notes,” are not often discussed in connection with Darwin’s views on chance, and these broader connections are incredibly instructive.

In this sense, then, I wish to express wholehearted agreement with one of Johnson’s central theses: that the exploration of Darwin’s various uses of “chance” ought to be one of the central foci in attempting to understand Darwin’s thought. Doing so can bring together parts of Darwin’s oeuvre not normally united in Darwin studies. For example, close attention to the use of chance serves as a fruitful way for Johnson to explore whether or not Darwin did, as has occasionally been alleged, become “more Lamarckian” over the course of his writings, offering greater pride of place to use and disuse. Examining how chance is invoked in Darwin’s discussions of giraffes added to the sixth edition of the *Origin* (in response, Johnson persuasively argues, to St. George Jackson Mivart’s extremely negative review of the *Origin*) lets us see that, in fact, Darwin’s attitude toward the role and prevalence of the inheritance

of characteristics via use and disuse remains roughly constant throughout Darwin’s works. Johnson has therefore set for himself an incredibly difficult task, one never to have been attempted in this form. The work is worthy of admiration for this reason alone.

3. Chance and chances in Darwin

We meet with problems, however, when we turn to Johnson’s central, and most controversial, thesis. Johnson argues that Darwin’s works, properly understood, will show that, while he believed as early as 1837 that “chance” was “a basic factor in evolution,” he consciously worked “to cast the role of chance in ways that, while preserving its central meaning, would either obscure its role in the theory or at least make it seem innocuous to otherwise friendly natural philosophers” (p. xiii).¹ According to Johnson, borrowing the coinage of Dennett (1995), Darwin saw chance as a “dangerous idea,” one that he would have to actively suppress within his writings in order to be accepted by the professional, theistic, British scientific establishment.

To begin to evaluate this claim, I want to focus on a particularly troublesome phrase in the quote above. Johnson argues that Darwin wanted to preserve the central meaning of chance in his works, despite surface-level alterations to the phrasing of his arguments. For the reasons already mentioned, however, I find it doubtful that, for Darwin, chance has a central meaning to be preserved in the first place.

In one sense, Johnson acknowledges this fact. Across his book, he details instances in which Darwin uses chance in a myriad different ways. Chance refers to something like “probability of survival” in the struggle for existence, as well as the “fortuity” that new variations will match environmental conditions and outcompete their rivals (p. xxi; this distinction is then collapsed on p. 11). We also have chance as unknowability (pp. xxiv, 111) both in practice (pp. 16, 105) and in principle (pp. xxiii, 17, 104, 113, 124, 191),² as phenomena which it is impossible to explain or understand (pp. 17, 124), as isotropy or randomness with respect to future adaptive needs (pp. xxiii, 13, 103, 112, 116), as absence of creative or designing power (pp. 37, 77), as causes of which we are currently ignorant (pp. 13, 76, 125) or laws of which we are currently ignorant (pp. 39, 137), as events which cannot be predicted (pp. 16, 111), or even as a cause in its own right (pp. 72, 171, 209).³ Unfortunately, these differing notions of chance are not clearly distinguished throughout the work, making the interpretation of some of Johnson’s central claims exceptionally difficult.⁴

¹ Page numbers without reference refer to Johnson.

² Notably, Johnson doesn’t believe the distinction between predictability in practice and predictability in principle to be relevant to his project here, because “as I see it, both classes are ‘chance’ variations for Darwin” (p. 68, note 10). This is odd, as he will go on to discuss this distinction, though only briefly, at pp. 175–181, and it is clear that it has bearing on his later discussions of the relationship between chance and predictability or understanding. Unfortunately, a discussion of the impact of the indefinite/definite variation distinction on Johnson’s arguments would require another essay of nearly this length.

³ This last notion, to the extent that it appears in Johnson’s work (e.g., that Darwin’s uses of the terms accident and happenstance “suggest ‘chance’ as the ‘cause’ of variation” (p. 172)) must be accidental, as Johnson elsewhere (e.g., p. 137) acknowledges that Darwin clearly believed that every event in the universe had a deterministic, law-like cause (deriving from his commitment to Herschel’s philosophy of science; see Hodge, 1992, 1989, 1983). As Manier accurately put the matter, Darwin “attributed no causal force to chance itself” (Manier, 1978, p. 121).

⁴ In the span of one paragraph, for example, Johnson writes that chance “meant ‘no assignable reason’” (perhaps unpredictability or unknowability in principle), that it also meant “cause unknown” (unknowability in practice, at least, if not in principle), as well as that the causes “ultimately may be resolved into deterministic laws” (ignorance of laws), and finally that those laws “are often beyond human comprehension” (unknowability in principle) and “cannot plausibly be assumed to be directed by divine intelligence” (lack of design; all p. 191).

A few of Johnson's arguments, on the other hand, are undermined by the *lack* of a handful of concepts of chance that other authors have taken to be important to Darwin. As an example, Darwin clearly recognized something not unlike the "law of large numbers"—i.e., that over a large number of trials, actual frequencies will converge with expected frequencies. Johnson quotes Darwin to this effect in Notebook B, arguing with respect to a point about the distribution of birds that "*Law of chance would cause this to have happened in all, but less in water birds*" (Darwin, 1837, p. B55e). Johnson, though, goes on to write:

A "law of chance"? That is a curious expression, because "law" and "chance" would seem to be opposed to one another. Darwin would soon come to recognize the incompatibility, but he would never — even in later life — come to resolve the inconsistency, at least in public expression, in favor of one or the other. (p. 90)

But nothing about this quote is particularly strange, nor does it reflect any deep incompatibility in Darwin's thought, if he has in mind something like the law of large numbers.

4. Arguments from chance

My primary worry with Johnson's book, then, derives from the combination of the trouble expressed above—that is, that there is no univocal category of "chance" for Darwin—with portions of Johnson's central argumentative thesis, which concern how Darwin's views about "chance" may or may not have changed over time.

When Johnson writes, then, that it is one of his central claims that 'chance' (in its primary meaning for Darwin) would be regarded as a 'dangerous' idea" (p. xiii), I doubt that we can evaluate whether this claim is true or false. Certainly, some things that Darwin meant by "chance" could have been, and were, regarded as dangerous—most prominent among them that particular features of species, including and most especially the intellect and moral faculties of humans, were not specially designed by a Creator. But many other things that Darwin certainly meant by "chance" were *not* so regarded.

To take one example, consider Johnson's claim that Darwin believed that the laws underlying "chance" phenomena were not designed by God and utilized as secondary causes. The argument goes something like this. It certainly is conceptually possible that "these laws might themselves have been designed to produce 'guided,' even 'foreseen' results. Plan, purpose, and design could be comfortably accommodated within a worldview that attributed natural productions to the operation of natural laws" (p. 76). This view was widely accepted by Darwin's contemporaries with respect to, for example, the laws of physics, but it was not, Johnson says, open to Darwin's laws of biology. Why not? First, the creative power itself would be "checked" by the operation of these laws, which Johnson describes as "a terrible blow to the creative power" (p. 77), despite this idea's long Newtonian heritage. Second, Darwin argues extensively against special creation in Lyell's sense—the notion that species were the products of individual divine creative acts (e.g., at Darwin, 1838a, p. E59). Together, Johnson argues that these positions entail that "Darwin had doubts that the natural laws were divinely created" (p. 78). Johnson takes the issue to be settled by a letter Darwin writes to Frances Wedgwood ("as revealing of his private views as any other letter I have seen"), in which Darwin claims that the combination of apparent evidence in favor of design (the overall harmony and order of the universe) and apparent evidence against design (the often haphazard structure of organisms) results in his being entirely perplexed about the question (quoted p. 81).

By just a few pages later, however, this ambiguity and perplexity disappears, with Johnson claiming that "[a] great deal of evidence from Darwin's private writings suggests that he regarded a role for Intelligence in the crafting of the laws of evolution to be as fanciful as the idea that Intelligence directly supervenes in the creation of species or the struggle of organisms in everyday life" (p. 84). I cannot discern on what evidential basis this claim is to be supported, particularly in light of Darwin's extensive writings reflecting both his confusion concerning matters theological and his frequent (if qualified) support of the divine origin of the laws underlying creation. To take just one example, consider the following passage from the D notebook:

What a magnificent view one can take of the world Astronomical & unknown causes modified by unknown ones, cause changes in geography & changes of climate suspended to change of climate from physical causes, — then suspended changes of form in the organic world, as adaptation, & these changing affect each other, & their bodies by certain laws of harmony keep perfect in these themselves. [...] How far grander than idea from cramped imagination that God created (warring against those very laws he established in all organic nature) the Rhinoceros of Java & Sumatra, that since the time of the Silurian he has made a long succession of vile molluscous animals. How beneath the dignity of him, who [interlined: is supposed to have] said let there be light & there was light. [interlined: bad taste: whom it has been declared "he said let there be light & there was light"] (Darwin, 1838b, pp. D36–7)

Putting aside Darwin's Unitarian doubt in the literal truth of the Genesis creation story (a doubt which he shared with many of his scientific contemporaries), on the basis of such evidence I would rather take Darwin at his word. Faced with a tally of accounts for and against design, he simply honestly reported his inability to come to any clear conclusion on the matter.

But it is here that we run into our recurring trouble with differing meanings of "chance." For it is certain that it would have been a *highly* "dangerous idea" for Darwin to suppose that God had absolutely *no* role even in the production of the deterministic laws underlying the phenomena that he would refer to, in our ignorance, as "chancy." Much different, on the other hand, is the status of his rejection of special creation. A long tradition in biology—including, perhaps most notably, Cuvier (Rudwick, 1997, p. 83)—had argued that withholding of judgment on the question of special creation was warranted, and even Lyell himself, while he did not remark in public on the processes that would create new species, argued in his private correspondence that (with the exception of man) this was likely to have been a naturalistic process (Rudwick, 1998, p. 8). The rejection of special creation, then, is not a very "dangerous" position.⁵ The fine details of just what Darwin means by invoking "chance," then—that is, whether this "chance" refers to the presence of unknown deterministic laws, or to the lack of overarching design, or to a process working randomly with respect to future adaptive needs, or what have you—are exceptionally important to the argument here, and are unfortunately absent.

Another problematic line of argument in Johnson's work concerns Darwin's own epistemic attitude toward his invocations of chance in the generation of variations. At the very opening of the book, Johnson claims that "Darwin did not expect ever to be able to

⁵ The parallel here between Johnson's claim that Darwin "was deterred from spelling out his deepest convictions in public writings" (p. 85) and Lyell's reticence to do the same is also quite interesting, though I lack space to comment upon it here.

provide the needed explanation for variations” (p. 3) – that is, the laws that would render them explicable in terms of their underlying deterministic laws.

The problem with this claim is that Darwin spent the better part of his career attempting to do precisely this. His theory of pangenesis was intended to explicate the very laws that would govern the reproduction and modification of traits over time, accounting for both resemblance to and difference from parents, as well as inheritance of acquired characters. Pangenesis receives a mere two pages at the end of a chapter on Darwin’s treatment of giraffes and relationship to Lamarckianism. Importantly, despite the fact that pangenesis was only published with the *Variation* near the end of Darwin’s career, Hodge has persuasively argued that the study of variation was a lifelong pursuit for Darwin, brought on in particular by Darwin’s work with his mentor Robert Edmond Grant. He writes, in a chapter titled “Darwin as a lifelong generation theorist”:

There can be no doubting that a major preoccupation of Darwin’s from 1837 to his final years was in extending analogical inferences, from the comparison of sexual and asexual modes of generation in individual organisms, to entities above and below them in the organizational hierarchy, all the way down to living “atoms” and all the way up the “tree of life.” (Hodge, 1985, pp. 237–238)

Theories of generation, that is, can be found from as early as Darwin’s B notebook up until his final writings. Darwin simply cannot, therefore, mean that the causes of variation are unknowable in principle, or that chance variation lies forever beyond our understanding. Many of them were certainly unknowable in practice, at the time—but this, again, is far from being a “dangerous idea.” It is, rather, the ignorance which drives the scientific process.

5. Too many chances

To sum up, then, Johnson’s book is difficult to evaluate. On the one hand, it offers a penetrating and insightful reading of an incredibly broad array of Darwin’s works, as well as many of the works involved in his reception in England. Johnson locates the full breadth of Darwin’s invocation of chance, pointing out adeptly and quite correctly that Darwin struggled with how to frame this concept over time and across areas of research, a struggle reflected both privately in the notebooks and correspondence and publicly in the published works. On the other hand, this reading is offered as evidence for a set of theses about the role of a univocal concept of “chance” in Darwin’s thought that is itself doubtful, and the argument for these theses seems tenuous on multiple counts.

I do think, however, that Johnson’s book can serve as an important spur to the community of historians and philosophers of biology working on Darwin. For I think the inescapable conclusion upon reading Johnson’s work, one for which Johnson extensively and entirely successfully argues, is that the plurality of meanings standing behind “chance” as Darwin uses it, as well as when it is

used as a cudgel against him by his critics, is much more significant an issue than has commonly been appreciated, and one that deserves more sustained and detailed attention. While Johnson’s work, therefore, is not the last word on the subject, it will be a significant contribution to our understanding of Darwin if it can serve as the first word in, following Johnson’s example, a more thorough exploration of Darwin’s use of chance and its role in his reception.

Acknowledgments

Thanks to Jon Hodge for comments on a draft, though all errors and misinterpretations are certainly mine.

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