

# Savage selection: analogy and elision in *On the Origin of Species*

D. Graham Burnett

Department of History and Program in History of Science, Princeton University, Princeton, NJ 08544, USA

**Darwin famously built the ground-breaking argument of *On the Origin of Species* out of an analogy between artificial selection ('breeding') and what he called 'nature's power of selection' – or, more famously, 'natural selection'. For years, historians of science have debated the origins of this analogy and philosophers of science have disputed exactly how well it works. But is Darwin's argument really an analogy? A closer look at what the world-travelling naturalist of the *Beagle* has to say about selection among 'savages' opens a more complicated story.**

## When analogies collapse

Imagine, for a moment, a book on the history of scientific method with the title '*When Analogies Collapse*'. It is a turn of phrase that captures something significant about a number of the most dramatic moments of scientific innovation. For example, the rise of the mechanical philosophy in the long seventeenth century can be understood as a dramatic collapse of the very old analogy that likened the dynamics of the heavens to the mechanics of mills and clocks, and the workings of living beings to their mechanical simulacra. To say the planets turn *like* a clock is one thing, to say that the heavens *are* a clockwork system (mechanized, not vital; slaved to an inner order, not infused with intelligence or appetite) is something altogether different, indeed, something very radical.

Then there's the late Renaissance collapse of the dualist ontology of the Scholastics, for whom the universe had been divided, broadly, into the sub- and superlunary, analogous realms perceived to be discrete and discontinuous. The notion that a continuity of forces and dynamics might link heaven and earth amounted to a revolutionary conflation of two realms. These two worlds, previously perceived to stand in a like/as relation, came, as a result of the work of Galileo and others, to be understood as a single entity. The collapse of the dominant analogy meant one no longer needed to speak in terms of similitudes, conveniences and correspondences; instead, one could now announce verities with a new sort of confidence.<sup>1</sup> Science itself, we might hazard, is precisely what happens when 'as' is replaced by 'is'. By these lights science becomes nothing less than the end of analogy.<sup>2</sup>

These are admittedly broad speculations, on matters about which much detailed and sophisticated work has

been done, so I put them forward provisionally, painting with broad brush to color a backdrop for the material I will treat here: the central analogy that organizes the opening four chapters of Charles Darwin's *On the Origin of Species*.<sup>3</sup>

## Darwin's analogy

Recall how this analogy is supposed to go: Darwin introduces his theory of 'evolution by natural selection' by means of an extended analogy with 'artificial selection' or, simply, 'breeding'. Just as human selective practices can accumulate variation in a particular direction, and in so doing generate and sustain new and distinct *varieties* (sometimes also called 'breeds' or 'races'), so natural selection, operating through the relentless selective action of what Darwin calls the 'struggle for existence', produces and maintains new and distinct *species*.

Why, if man can by patience select variations most useful to himself, should nature fail in selecting variations useful, under changing conditions of life, to her living products? [p. 469]<sup>4</sup>

This apparent analogy – which structures the first four chapters of the book and is an important resource throughout – has not gone unremarked by scholars of Darwin and Darwinism. In fact, there has been considerable commentary, particularly among philosophers of science, concerning the structure and implications of the analogical argument, what it tells us about Darwin's thinking on the nature of scientific investigation itself, as well as the status of the analogy in justifications of the theory.<sup>5</sup> For historians, the analogy has come to be entangled in several perennial Darwin questions: Where did Darwin get his ideas? What was the precise chronology of his theory's formulation? The place of the analogy in these investigations is interesting: while Darwin claimed in his autobiography (and elsewhere) that the critical notion of natural selection actually occurred to him first as an explicit parallel to the breeder's selection, this, it turns out, was not precisely the case. Moreover, close work on Darwin's sources has revealed that something very much like natural selection had been identified by breeders themselves well before Darwin's own formulation of the theory, and, revealingly, in the context of a loose analogy to their own selective efforts.<sup>6</sup> Interesting as these findings are, they have been developed elsewhere (including in this publication), so I will not rehearse them in further detail here.<sup>7</sup>

Corresponding author: Burnett, D.G. (dburnett@princeton.edu).

Instead, I wish to take up a peculiarity of this analogy that has been overlooked, and that has interesting implications for how we think about Darwin's work as a whole. Stated most hyperbolically, I will argue that this analogy is, in fact, not a true analogy at all, if by 'analogy' one means a systematic and revelatory juxtaposition of two discrete and discontinuous entities.<sup>8</sup> Rather, what Darwin offers is something more like a spectrum – a broad, continuous array of slightly modified instances of a single entity. In other words, I want to argue that Darwin's analogy turns out to be one of those collapsing analogies that I have suggested are so potent in the history of science. If I am right, there are interesting implications for our understanding of the *Origin*.

### Analogy or spectrum?

So let me try to establish my basic claim: that this apparent analogy between natural and artificial selection, works out, on closer examination, to look much less like a catalog of comparatives between two discrete elements and much more like a continuous spectrum of slight modifications on a single phenomenon. Let us begin with the analogy itself.

Starting (as Darwin does) with artificial selection, we recall that in chapter one Darwin asks the following question: what is the origin of domestic breeds, or 'varieties'? After rejecting two commonly held positions on this subject (one, the argument that individual breeds are the domesticated survivors of once-wild natural varieties now extinct; the other that domestic breeds are hybrid lines produced out of the crossing of wild species), Darwin goes on to establish quite successfully that the origin of domestic breeds in fact lies in the 'power of accumulative selection.' As he puts it:

[N]ature gives successive variations; man adds them up in certain directions useful to him. In this sense he may be said to make for himself useful breeds. [p. 30]

Having thus laid down the more familiar part of his analogy, Darwin posits a quite novel parallel process, which he calls 'natural selection' (writing that he named it in this way 'to mark its relation to man's power of selection' [p. 61]). This is a principle, he writes, 'by which each slight variation, if useful, is preserved.' The product of these preservations of useful variations (through the 'struggle for existence') is nothing less than species themselves:

Slow though the process of selection may be, if feeble man can do much by his powers of artificial selection, I can see no limit to the amount of change, to the beauty and infinite complexity of the coadaptations between all organic beings, one with another and with their physical conditions of life, which may be effected in the long course of time by nature's power of selection. [p. 109]

Thus far this seems like an analogy in the plainest sense. But is it? Perhaps not. Let's look a little closer. Consider this excerpt from chapter one in which Darwin introduces the notion of 'unconscious' selection:

At the present time, eminent breeders try by methodical selection, with a distinct object in view, to

make a new strain or sub-breed, superior to anything existing in the country. But, for our purpose, a kind of Selection, which may be called Unconscious, and which results from every one trying to possess and breed from the best individual animals, is more important. Thus, a man who intends keeping pointers naturally tries to get as good dogs as he can, and afterwards breeds from his own best dogs, but he has no wish or expectation of permanently altering the breed. Nevertheless I cannot doubt that this process, continued during centuries, would improve and modify any breed, in the same way as Bakewell, Collins, &c., by this very same process, only carried on more methodically, did greatly modify, even during their own lifetimes, the forms and qualities of their cattle. [p. 34]

What, precisely, are we to make of 'Unconscious Selection' in the schema of the analogy? It fits under neither of our established analogical categories – it is neither properly 'natural' (as in 'happening out there in *nature*'), nor is it exactly 'artificial,' in the sense of being 'methodical breeding' directed by conscious human agency using the techniques Darwin witnessed among the pigeon fanciers.<sup>9</sup> Instead, this unconscious selection falls 'between' the two analogical poles.

Darwin does not leave things there, but pushes this notion of unconscious selection even further a little later in chapter one. For instance:

If there exist savages so barbarous as never to think of the inherited character of the offspring of their domestic animals, yet any one animal particularly useful to them, for any special purpose, would be carefully preserved during famines and other accidents, to which savages are so liable, and such choice animals would thus generally leave more offspring than the inferior ones; so that in this case there would be a kind of unconscious selection going on. We see the value set on animals even by the barbarians of Tierra del Fuego, by their killing and devouring their old women, in times of dearth, as of less value than their dogs. [p. 36]

Darwin presents a kind of unconscious selection that is, in a sense, even *more* unconscious. Here we have the 'lowest savages' who *not only* do not have any explicit program for modifying or improving their breeds (as we would expect from a methodical selectionist), but who are not even bothering to breed from their own best animals out of some vague sense of wanting to maintain their stock, as in the case of proper 'unconscious selection.' Rather, these 'savages' merely cease to give scraps to any but their favorite animal when the time comes to tighten belts around the campfire (Fig. 1). I think it no distortion to call this selective instance 'Extra Unconscious Selection.'

There are still further forms of selection that Darwin considers:

But to use such an expression as trying to make a fantail, is, I have no doubt, in most cases, utterly incorrect. The man who first selected a pigeon with a slightly larger tail, never dreamed what the descen-



Fig. 1. In the *Origin* Darwin speculated at some length about the way selection worked in the borderlands between nature and culture. He was clearly thinking back to formative experiences among the “savages” of his circumnavigation. Above, Conrad Marten’s watercolor of the Beagle being greeted by natives in the Murray Narrows, Tierra Del Fuego.

dants of that pigeon would become through long-continued, partly unconscious and partly methodical selection. [p. 39]

So here, in the context of pigeon fanciers, we have a kind of selection that is itself a sort of hybrid, having some of the qualities of unconscious selection and some of the characteristics of methodical selection.

And, finally, a passage I take to be a very significant transitional point in Darwin’s argument:

In regard to the domestic animals kept by uncivilised man, it should not be overlooked that they almost always have to struggle for their own food, at least during certain seasons. And in two countries very differently circumstanced, individuals of the same species, having slightly different constitutions or structure, would often succeed better in the one country than in the other, and thus by a process of ‘natural selection,’ as will hereafter be more fully explained, two sub-breeds might be formed. [p. 38]

Now here, even though Darwin uses the term ‘natural selection,’ we can see that he has put it in scare quotes, and it is clear why: for this is really a sort of ‘semi-natural selection,’ in that we are still talking about semi-domesticated animals, animals that are only foraging during some seasons, or for some of their nourishment. These are not animals in a state of nature subjected to ‘purely natural’ selective forces, but rather animals in a highly liminal state, poised on the very cusp of the nature–culture divide. Whatever selection they experience is just about untouched by human agency, both because these animals only drift into the human sphere sporadically, and also because the humans they do encounter, according to the parlour chat of the day, are barely human anyway.

At this point I hope that I have shown that to call the relationship between natural and artificial selection a simple analogy does not adequately characterize Darwin’s efforts to blur the *differentia* out of which analogies are built. Rather, what we get in the first four chapters of the *Origin* is something much more like a spectrum of different

Artificial Selection	Accumulative effect produces : <b>Varieties</b> Agent : <b>Humans</b>
Partly Methodical / Partly Unconscious Selection	
Unconscious Selection	
Extra Unconscious Selection	
Just-About-Natural Selection	
Natural Selection	Accumulative effect produces : <b>Species</b> Agent : <b>“Nature” (Chance? Nothing?)</b>

Fig. 2. Analogy or spectrum? The basic argument of the *Origin* seems to hinge on an analogy between natural and artificial selection. But closer examination reveals a range of different selective situations that fall somewhere in between, and blur the very distinction upon which the analogy seems to rely.

sorts of selection, a continuous sequence of variations rather than the juxtaposition of discrete elements (Fig. 2).

It is interesting to note in passing that this spectrum of selective instances is, significantly, underwritten by a socio/intellectual spectrum as well (Fig. 3). What I have done here in Fig. 3 is plot each mention of a selecting agent in the first four chapters according to the indicated degree of agency brought to bear by the agent. It quickly becomes clear that a ranking of selecting agents, from most to least methodical, mirrors an established Victorian hierarchy of intelligence and social standing. We will shortly see the significance of this other spectrum, which is both implied by the spectrum of selective instances laid out in the previous figures and in turn reinforces it.

### Have the cake, eat it too

So what is the function of Darwin’s ‘collapsing’ analogy? How does it advance his larger argument about the dynamics of the natural world? I am going to offer three answers.

First, the collapsing analogy structure provides a powerful tool for confronting one of the most conceptually challenging parts of Darwin’s theory – namely, the problem of agency. After all, returning for a moment to the original analogy, it must be acknowledged that there is *all the difference in the world* between saying, on one hand, ‘selection is a thing that is done by people who select’ (as in the case of artificial selection), and saying, on the other hand, ‘selection is a thing that is done without a selecting being of any kind’ (as we are to understand in the case of Darwin’s putative natural selection). What, after all, is ‘selection’ without a ‘selector’? It is a question that one continues to hear raised by opponents of the theory of evolution by natural selection. As it happens, Darwin explicitly rejects any notion that his natural selection proceeds by means of the intelligent selecting agency of some supernatural being. His ‘natural selection’ is precisely a selection that just happens.

Artificial Selection		
Sir John Sebright [p. 31]	Methodological	
Lord Somerville [p. 31]		
Lord Spencer [p. 35]		
Bakewell, Collins, &c. [p. 35]		
Thoroughbred Breeders [p.35]		
Saxon Sheep Connoisseurs [p. 31]		
Some Fanciers and Horticulturalists [ <i>passim</i> ]		
Other Fanciers and Horticulturalists [p. 32]	Mixed	
Gardeners [p. 37]		
Leicester Sheep Farmers [p. 36]		
Rude and Barbarous Englishmen of Old [p. 34]	Unconscious	
Half-Civilized Man [p. 24]		
Esquimaux [[p. 34]		
Savages of South Africa/Australia [p. 34]		
Barbarians of Tierra Del Fuego [p. 36]		
Natural Selection		

Fig. 3. Can selection happen without a selector? Darwin adduced examples of selective situations that tended to elide the question of agency—and did so by trading on a (tacit) Victorian socio/intellectual hierarchy.

By structuring selection as a spectrum of more and less volitional circumstances, Darwin can gradually diffuse, disburse and ultimately efface altogether, the need for selecting ‘minds,’ while retaining his notion of selection. In this enterprise, what I have called his ‘socio/intellectual hierarchy’ does much rhetorical labor. After all, it is quite clear that mind, agency and intellect operate in the upper reaches of that spectrum – in the neighborhood of Sir John Sebright and Lord Somerville – and, yes, mind must be acknowledged to be operating in that middle zone too, but there is manifestly less and less of it operational as Darwin leads his readers to consider barbarians and savages, until, when he speaks of the wild beings of Tierra del Fuego, he expects his audience to recognize practically no forethinking intelligence at all. Darwin, in other words, is trading heavily on mid-Victorian notions of ‘natural man’ to serve as his ‘missing link’ in our understanding of natural selection.

And, indeed, when he gets into sticky situations in his argument, it is this ‘save’ sort of selection, this unconscious, ‘almost natural,’ sort of selection that he trucks out to help smooth the ride.<sup>10</sup> For instance, when, in chapter four, Darwin finally offers his first explicit illustration of natural selection – involving the development of slimmer, swifter wolves as a result of an increase in the number of their swiftest prey, deer – he immediately returns to how greyhounds can be made more swift not only by methodical selection, but, as he puts it ‘by that unconscious selection

which results from every man trying to keep the best dogs without any thought of modifying the breed’ [p. 90]. When confronted with the first challenge of explaining how selection can occur in nature, without a selecting intelligence, Darwin reminds the reader that real, efficacious selection in the absence of conscious intent has already been established.

For another example one need only read ahead a few pages, where Darwin must explain how intercrossing will not erase whatever variation has begun to accumulate (another real challenge to his theory). Once more, it is precisely to the power of unconscious selection that Darwin appeals:

In man’s methodical selection, a breeder selects for some definite object, and free intercrossing will wholly stop his work. But when many men, without intending to alter the breed, have a nearly common standard of perfection, and all try to get and breed from the best animals, much improvement and modification surely but slowly follow from this unconscious process of selection, notwithstanding a large amount of crossing with inferior animals. Thus it will be in nature. . . [p. 102]

There is, I think, a second way that Darwin’s collapsing analogy advances his case, and it amounts to a kind of pivot on the first. For whilst the spectrum-like structure secreted in the collapsing analogy gives Darwin a much-needed way gently to efface the intelligence from a selecting process, the actual *analogical* part of the analogy can still be marshaled at certain critical moments in his arguments, where it does some heavy lifting.

After all, what about the enormous differences between the products of natural and artificial selection? Darwin can only show that artificial selection produces varieties – relatively small-scale organic difference. How, then, can he justify his assertion that natural selection has the power to make not only species, but, ultimately, to produce divergences in living beings so great that we give them higher taxonomic classifications such as orders, families and phyla? Confronting this question, Darwin falls back on a potent (Romantic) concept of nature’s grandeur and power before man’s transience and impotence. Here are two good examples of this rhetoric, where exclamatory perorations and hyperbolic juxtaposition sweep readers past a synapse in Darwin’s account:

We have seen that man by selection can certainly produce great results, and can adapt organic beings to his own uses, through the accumulation of slight but useful variations, given to him by the hand of Nature. But Natural Selection, as we shall hereafter see, is a power incessantly ready for action, and is as immeasurably superior to man’s feeble efforts, as the works of Nature are to those of Art. [p. 61]

How fleeting are the wishes and efforts of man! how short his time! and consequently how poor will his products be, compared with those accumulated by nature during whole geological periods. Can we wonder, then, that nature’s productions should be far ‘truer’ in character than man’s productions; that they

should be infinitely better adapted to the most complex conditions of life, and should plainly bear the stamp of far higher workmanship? [p. 84]

Darwin is, in a manner of speaking, both having his analogical cake and eating it too. He gets to use the slippery slope of selection to elide the problem of agency, even as he gets to use the endpoints as footholds for a crucial Romantic trope, advancing his claim by means of a period commonplace that set the vast powers of nature far beyond those of mere men.<sup>11</sup>

Having noticed this puts us in a position to see the third aspect of the collapsing analogy's rhetorical power: namely, that it recapitulates the central project of his text as a whole, which, remember, involves showing that species and varieties are not really discrete categories, different in kind, but merely more and less well-marked cases of organic specialization—differences of degree. Recall the standard analogical argument: natural selection is supposed to make species, just as artificial selection makes varieties. But what Darwin is in fact trying to argue throughout the first chapters of the *Origin* is that the species/variety distinction is itself essentially arbitrary: 'practically,' he writes in chapter two, 'when a naturalist can unite two forms together by others having intermediate characters, he treats the one as a variety of the other.' [p. 47] When the intermediate forms are missing, however, the organisms come to be understood as distinct species. Darwin prepares the ground for his reinterpretation of order in nature exactly by showing how much confusion dogged naturalists who tried to distinguish rigorously between species, subspecies and varieties.

Given, then, that what Darwin is trying to do in these chapters is, effectively, to *elide* species and varieties (as he puts it, to show that they, 'blend into each other in an insensible series; and a series impresses the mind with an idea of actual passage' [p. 51]) it would hardly make sense for him to argue that they took rise in distinct processes. Rather, he needs to show that their 'manufactories' (his term, in the singular [p. 56]) also blend into one another in a sort of 'insensible series.'

And, best of all, just as we tend to think of varieties and species as distinct because the intermediate forms are either unknown to us or extinct, so too, we are likely to miss the continuity of selective forces that Darwin illustrates precisely because 'natural man' is 'missing.' Missing in two senses: first, in that savages are distant from metropolitan culture both temporally and spatially; and, second, because, as was well-known, indigenous people were rapidly vanishing before the expanding European empires of the mid-nineteenth century. The missing link, was, in this sense, extinct.

### Warning: slippery analogies ahead!

It has been my argument that on closer examination Darwin's striking analogy between natural and artificial selection looks less like a garden-variety analogy than an exotic chameleon capable of quick changes in appearance: here it seems to work as an instructive juxtaposition between two discrete kinds of selection, but moments later it has resolved into a full-spectrum array of minute vari-

ations of a single concept of selection. I have called this hybrid structure a 'collapsing analogy' and have tried to show that it served several important functions in the formulation of Darwin's argument. In closing, it is perhaps worth noting that the natural selection/artificial selection analogy on which I have focused is just one aspect of the much larger, indeed cataclysmic, collapsing analogy which I take to lie at the heart of Darwin's claim about nature: the collapse of the timeless analogy that likened human beings to a God in their image. Of that a great deal remains to be said, but allow a single reflection.

At the outset I made the claim that, from a certain perspective, we might think of science as defined by the moment that 'as' gives way to 'is,' or, to put it differently, the moment when the tenor and the vehicle of a dominant metaphor collide, leaving a theory of the nature of things where once lay a theory of the appearances of things. Consider Darwin's collapsing analogy in this light: whereas he sets his readers to consider two kinds of analogous selection – one natural, the other not, one without agency, the other seemingly with – the effect of his argument is precisely to collapse such distinctions. Because human beings are, in his mature account, *part of nature*, their selective practices cannot in any significant sense be understood to fall outside of nature: artificial selection is by these lights just a peculiar variety of 'natural selection.'

The implications continue to have staggering weight: here was a slip from 'as' to 'is' which seems to have done nothing less than erase human beings themselves, to have made it possible for us to think of ourselves as not distinct from nature, not distinct from a nature defined as being without mind, without agency, without intelligence. This is, of course, one of the great inflection points in the history of ideas, and a crucial intersection between intellectual history and the history of science. It remains unclear to me to what degree Darwin sensed this larger movement in his own thought, but for better or worse, these serious matters freight his legacy.

### References and notes

- 1 I have discussed this at greater length in: 'The Cosmogonic Experiments of Robert Fludd,' *Ambix* LXVI:3 (November, 1999).
- 2 There is a large literature on the place of analogy in science, too large to summarize concisely, though it informs my argument here. Points of departure would include: Max Black, *Models and Metaphors* (Ithaca: Cornell University Press, 1962); and Mary Hesse, *Models and Analogies in Science* (South Bend, IN: University of Notre Dame Press, 1966). Other relevant works include: W.H. Leatherdale, *The Role of Analogy, Model, and Metaphor in Science* (New York: American Elsevier, 1974); John D. North, 'Science and Analogy,' in *On Scientific Discovery*, edited by M.D. Grmek, R.S. Cohen, and G. Cimino (Dordrecht: D.Reidel, 1980) pp. 115–140; and A. Biela, *Analogy in Science* (New York: P. Lang, 1991). Of particular interest for a consideration of analogy and theory development: Max Black, 'More about Metaphor,' and Richard Boyd, 'Metaphor and Theory Change,' both in *Metaphor and Thought*, edited by Andrew Ortony (Cambridge: Cambridge University Press, 1979).
- 3 The most complete treatment remains: L.T. Evans, 'Darwin's use of the analogy between artificial and natural selection' *Journal of the History of Biology* 17 (1984): 113–140. But see also: R.M. Young, 'Darwin's Metaphor: Does Nature Select?' *Monist* 55 (1971): 442–503; P.J. Vorzimmer 'Darwin's Questions about the Breeding of Animals,' *Journal of the History of Biology* 2 (1969): 269–81; and the works cited below, notes 5 and 6.

- 4 All bracketed page citations from *the Origin* are from: C. Darwin, *On the Origin of Species* (A Facsimile of the First Edition), introduced by Ernst Mayr (Cambridge: Harvard University Press, 1964).
- 5 See, for instance: C.K. Waters, 'Taking Analogical Inference Seriously: Darwin's Argument from Artificial Selection,' *PSA: Proceedings of the Biennial Meeting of the Philosophy of Science Association* (1986) volume 1: 502–13; Michael Ruse, 'Darwin's Debt to Philosophy,' in idem, *The Darwinian Paradigm* (London: Routledge, 1989); idem, 'The Value of Analogical Models in Science,' *Dialogue* 12 (1973): 264–53; Richard A. Richards, 'Darwin and the Inefficacy of Artificial Selection,' *Studies in the History and Philosophy of Science* 28 (1997): 75–97; idem, 'Darwin, domestic breeding, and artificial selection,' *Endeavour* 22 (1998): 106–109, and idem, 'Is Domestic Breeding Evidence For (or Against) Darwinian Evolution?' in *Scientific Evidence: Philosophical Theories and Applications*, edited by Peter Achinstein (Baltimore: Johns Hopkins University Press, 2005): 107–236.
- 6 These debates are reviewed in: Michael Ruse, 'Charles Darwin and Artificial Selection,' *Journal of the History of Ideas* 36 (1975): 339–50. See also: P.J. Vorzimmer, 'Darwin, Malthus and the Theory of Natural Selection,' *Journal of the History of Ideas* 30 (1969); S. Herbert, 'Darwin, Malthus, and Selection,' *Journal of the History of Biology* 4 (1971): 209–17; and S. Smith 'The Origin of "The Origin"' *Advancement of Science* 64 (1960): 391–401. Also useful is: D.R. Oldroyd, 'How Did Darwin Arrive at his Theory? The Secondary Literature to 1982' *History of Science* xxii (1984): 325–74.
- 7 I am also omitting treatment of the broader response of readers and colleagues to the analogy. For instance, Young ('Darwin's Metaphor: Does Nature Select?' cit. n. 3) cites Wallace's strenuous objections. For a broader discussion, see: D. Hull, *Darwin and His Critics* (Cambridge: Harvard University Press, 1973).
- 8 Note that in a suite of essays Richards (cit. n. 5) also calls into question whether the relationship of artificial to natural selection can properly be called an analogy, given Darwin's reliance at several points on an explicit disanalogy homologous with the analogy itself, as when he shifts to emphasizing the vast differences between 'Man' and 'Nature' as selective agents. I present an alternate interpretation of Darwin's oscillation between analogy and disanalogy, though with Richards' main point – that the analogical structure should be understood less as a logical move in the pursuit of causal efficacy, and more as a heuristic (i.e. that it serves a primarily *rhetorical* function) – I would concur.
- 9 My analysis here is at odds with that of Susan Sterrett, who understands Darwin to identify two forms of artificial selection, one 'conscious' and the other 'unconscious,' and to give them different functions in his account of evolution. See her 'Darwin's analogy between artificial and natural selection: how does it go?' *Studies in History and Philosophy of Biological and Biomedical Sciences* 33 (2002): 151–168.
- 10 Though I cannot deal here with the way 'savage' and 'unconscious' selection were taken up by Darwin's readers, it is worth noting that he was not alone in using these notions to navigate the stickiest terrain in evolutionary arguments. For a particularly stimulating example, consider their use by Walter Bagehot, who lays the origins of human civilization as well as the origins of human racial differentiation at the feet of savage and 'unconscious' selection, respectively: Walter Bageot, *Physics and Politics* (London: Henry King, 1872).
- 11 On the relative impotence of human selective efforts, see: R. Richards, 'Darwin and the Inefficacy of Artificial Selection,' *Studies in History and Philosophy of Science* 28 (1997): 75–97.