

THE ORIGIN CYCLE

Libretto and Program Notes

Quotations are from the first edition of Darwin's *On the Origin of Species* (1859).

The Face of Nature

Elliott Gyger

We behold the face of nature bright with gladness, we often see superabundance of food; we do not see, or we forget, that the birds which are idly singing round us... are ... constantly destroying life; or we forget how largely these songsters, or their eggs, or their nestlings are destroyed by birds and beasts of prey....

The face of Nature may be compared to a yielding surface, with ten thousand sharp wedges packed close together and driven inwards by incessant blows, sometimes one wedge being struck, and then another with greater force.

This first passage (Chapter 3, pp. 62-67) features a contrast between a pre-Darwinian view of nature and the "struggle for existence" that Darwin came to see as crucial to an understanding of the biological world. We "behold the face of nature bright with gladness," but fail to realize the destruction underneath. At this stage of the *Origin*, Darwin introduces the "struggle" but does not yet trace out its consequences.

This part of Darwin's thinking was influenced by his reading of Thomas Malthus' *Essay on The Principle of Population* (1798), a pessimistic work in which Malthus argued that poverty and suffering were inevitable features of human life, due to the tendency of reproduction to outstrip the food supply. In an earlier essay, written in 1844, Darwin described his picture of the biological world as "the doctrine of Malthus applied in most cases with ten-fold force."

This piece, Gyger writes, "falls into two distinct sections. In the first, the ensemble is a hive of feverish activity, in which the various instruments sometimes blur, and at other times emerge as individual characters; the voice, initially a detached observer, is subsequently drawn into the fray." This first section opens with a percussive instrumental section exploring extremes of pitch, dynamic, and instrumental technique. The second section brings the ensemble together as a single entity. Through this section the vocal line "is a polyphony of three distinct strands, each with its own character", one strand subjected to "incessant blows" from the other two.

Hourly Scrutinising

Kate Neal

It may be said that natural selection is daily and hourly scrutinising, throughout the world, every variation, even the slightest; rejecting that which is bad, preserving and adding up all that is good; silently and insensibly working, whenever and wherever opportunity offers, at the improvement of each organic being in relation to its... conditions of life. We see nothing of these slow changes in progress, until the hand of time has marked the long lapse of ages....

In this second passage (Chapter 4, p. 84), Darwin begins to describe a new kind of order and pattern underlying the apparently chaotic struggle for life. Darwin assumes that variation between individuals will constantly tend to arise. Most new variations are bad for the organisms that bear them, but occasionally a small change appears which helps an organism in the struggle. If this variation is also inherited across generations, then this trait will tend to become more common. Further variation arises against that new background, and the process continues. This is the Darwinian explanation for the adaptation of organisms to their circumstances. Darwin saw this as a gradual process; significant biological change involves the accumulation of many of these small changes over "the long lapse of ages."

A depiction of this slow process of change initiates Neal's piece. The final sentence of the text opens the work, and after establishing a spacious texture flecked with harmonics and populated with microtones, Neal sets a vocal melody repeating the beginning of the passage, with a gentle persistence and marked by occasional, tiny variations on the original melodic material. The results of natural selection's fine-grained scrutiny are brought to life when this vocal line is eclipsed by a rich instrumental section marked "wild and untamed". Bringing our awareness back to the minute workings of Darwin's mechanism, Neal closes the piece by quoting once more a variation on her initial vocal melody.

Tree of Life

Elena Kats-Chernin

As buds give rise by growth to fresh buds, and these, if vigorous, branch out and overtop on all sides many a feebler branch, so by generation I believe it has been with the great Tree of Life, which fills with its dead and broken branches the crust of the earth, and covers the surface with its ever branching and beautiful ramifications.

This passage, one of the most famous in the *Origin*, is taken from Darwin's main presentation of the idea of a genealogical "tree" connecting all life on earth (Chapter 4, p. 130). The idea of using a tree shape to represent groupings of

organisms was not new with Darwin. What Darwin did was to give the "tree of life" a genealogical interpretation. He argued that species in the same genus, for example, will have a relatively recent common ancestor. The "ancestor" here is a species or population which split at some point and gave rise to two. Species from very different groups – for example, a species of monkey and a species of beetle – have a common ancestor living much further back. Darwin was unsure whether all of life on earth comes from a single "root," or perhaps a few. It is now believed that there is a single tree.

Darwin's tree of life represents another kind of order in the natural world which is visible only from a vantage point encompassing vast stretches of time. The passage is important also as an expression of an aesthetic perspective in which the destructive and creative aspects of evolution are tied together; the tree of life "fills with its dead and broken branches the crust of the earth, and covers the surface with its ever branching and beautiful ramifications."

Elena Kats-Chernin has opted for a simple setting of the passage, utilizing a smaller ensemble. It has as its foundation a simple arpeggio structure reflecting the simplicity of the tree image. Unlike other pieces in the program, Kats-Chernin limits her musical materials to those in common usage at Darwin's time. The small ensemble and circumscribed harmonic pattern suggest the intimacy of the Victorian parlor. This is a reminder of the life that Darwin himself lived – that of a gentleman scientist on a rural English estate.

Comparing the Eye to a Telescope

Barry Conyngham

If we must compare the eye to an optical instrument, we ought in imagination to take a thick layer of transparent tissue, with a nerve sensitive to light beneath, and then suppose every part of this layer to be continually changing slowly in density,... the surfaces of each layer slowly changing in form. Further we must suppose that there is a power always intently watching each slight accidental alteration in the transparent layers; and carefully selecting each alteration which... tend to produce a distincter image. We must suppose each new state of the instrument to be multiplied by the million... and then the old ones to be destroyed.

In living bodies, variation will cause the slight alterations, generation will multiply them almost infinitely, and natural selection will pick out with unerring skill each improvement. Let this process go on for millions on millions of years; and during each year on millions of individuals of many kinds; and may we not believe that a living optical instrument might thus be formed as superior to one of glass, as the works of the Creator are to those of man?

Having developed his main theoretical ideas, in later chapters of the *Origin* Darwin addresses particular phenomena, including those that pose problems for

his theory. This passage (Chapter 6, pp. 188-89) is from his discussion of "organs of extreme perfection," where the eye is Darwin's primary example.

Darwin had been influenced by the "Natural Theology" tradition, which sought to demonstrate the reality and omnipotence of the Creator by describing the complex design of organisms and their adaptation to their circumstances. Earlier in his book Darwin said that no theory of the origin of species would be adequate unless it explained how organisms had acquired "that perfection of structure and coadaptation which most justly excites our admiration" (p. 3). Here he grapples directly with this problem, choosing what would have been regarded as an especially difficult case.

Darwin's answer invokes, among other things, the multiplication of any useful new variant through reproduction, resulting in many opportunities for further improvement. The same multiplicative tendency which leads to the destruction described in *The Face of Nature* has a creative role here. Conyngham's setting features both dramatic "multiplications" and frequent shifts in texture. The flute develops an intricate filigree from the opening, and the other lines are eventually drawn into a frenzy of activity, each instrument studying an atom of independent detail.

Economy of Wax

Nicholas Vines

We hear from mathematicians that bees have... solved a recondite problem, and have made their cells of the proper shape to hold the greatest possible amount of honey, with the least possible consumption of... wax in their construction...

[A] score of individuals work even at the commencement of the first cell. I was able ... to show this fact, by covering the edges of ... the extreme margin of the circumferential rim of a growing comb, with an extremely thin layer of melted vermilion wax...

[T]he colour was most delicately diffused by the bees as delicately as a painter could have done with his brush by atoms of the coloured wax... worked into the growing edges of the cells all round. The work of construction... a... balance struck between many bees,... all trying to sweep equal spheres, and then building up, or leaving ungnawed, the planes of intersection between these spheres....

The bees, of course, no more knowing that they swept their spheres at one particular distance from each other, than they know what are the several angles of the hexagonal prisms and of the basal rhombic plates. The motive power of the process of natural selection having been economy of wax....

This passage (Chapter 7, pp. 224-235) is from Darwin's chapter on instincts, which features a long and careful discussion of how bees construct honeycomb.

Here we see a different side of Darwin's intellectual powers – his ability to immerse himself obsessively in tiny empirical details.

This obsessiveness is captured by Nicholas Vines' setting, which derives its musical materials and structure from the geometry of honeycomb construction. The piece presents regular changes in time signature, a reflection of the organization of a honeycomb lattice in a repeated structure involving two displaced layers. The piece also has a particular harmonic event of two seconds duration every twelve seconds, suggesting the internal regularity of the honeycomb structure. Within this meticulous geometric framework, the tone of the piece is one of ecstatic immersion, reflecting both Darwin's obsessive immersion in his work and the frantic activity of the bees themselves. Vines writes that "waxing and waning tremolo and trills mimic" the "score of individuals" Darwin describes at work on the comb, and the piece ends with a "final ecstatic heraldry" for the scientific conclusion Darwin reaches at the end of the passage.

A History Imperfectly Kept

Dan Walker

[I]f my theory be true, it is indisputable that before the lowest Silurian stratum was deposited, long periods elapsed, as long as, or probably far longer than, the whole interval from the Silurian age to the present day; and that during these vast, ... unknown, periods of time, the world swarmed with living creatures.

To the question why we do not find records of these vast primordial periods, I can give no satisfactory answer....

I look at the natural geological record, as a history of the world imperfectly kept, and written in a changing dialect; of this history we possess the last volume alone, relating only to two or three countries. Of this volume, only here and there a short chapter has been preserved; and of each page, only here and there a few lines. Each word of the slowly-changing language, in which the history is supposed to be written, being more or less different in the interrupted succession of chapters, may represent the apparently abruptly changed forms of life, entombed in our consecutive... formations.

One of the hardest problems Darwin faced was making sense of the fossil record. He devoted a chapter to this topic, from which this passage is taken (Chapter 9, pp. 307-11). The main problem was that the earliest known fossils in Darwin's time were apparently of quite complex organisms. But according to Darwin, those organisms must have gradually evolved from much simpler ones. Why is there no trace of these precursors, below the "Silurian" strata in which the earliest fossils were found? Darwin was forced to argue that the fossil record was much more imperfect than people had supposed.

The piece opens shifting slowly back and forth between two chords, two harmonic strata. Walker's setting represents Darwin's image of the fragmentation of a linguistic message with a partial fragmentation of the text itself. But not until after the opening has been clearly stated, and we have come to expect the text to behave normally, does Walker suddenly obscure part of a phrase, leaving us momentarily unmoored before normal phrasing is restored.

Entangled Bank

Paul Stanhope

[C]ontemplate an entangled bank, clothed with many plants of many kinds, with birds singing on the bushes, ... insects flitting about, and with worms crawling through the damp earth,...

[R]eflect that these elaborately constructed forms, so different from each other, and dependent on each other in so complex a manner, have all been produced by laws acting around us.

Thus, from the war of nature, from famine and death, the most exalted object which we are capable of conceiving, namely, the production of the higher animals, directly follows.

This passage is from the last pages of the *Origin* (Chapter 14, pp. 489-490), where Darwin expresses in the fullest and most explicit terms the view of nature that has emerged from the preceding chapters. In particular, Darwin explicitly asserts the connection his theory forges between destructive and creative aspects of life: "from the war of nature, from famine and death, the most exalted object which we are capable of conceiving... directly follows."

This is the full development of a theme introduced in the second passage above. Darwin first sees destruction and competition on a scale that had not before been appreciated – the Malthusian image of nature – and then comes to see an unexpected creativity inherent in this picture.

Paul Stanhope's setting of this text has two main sections. In the first, the harp is featured with the most detailed line, while the other elements of the ensemble begin sparsely and gain complexity as they draw attention to the birds and insects of the text. The second half states the final paragraph over a river of triplets, building an insistent momentum toward the piece's finish.

There is grandeur in this view of life, with its several powers, having been originally breathed into a few forms or into one; and that, whilst this planet has gone cycling on according to the fixed law of gravity, from so simple a beginning endless forms most beautiful and most wonderful have been, and are being, evolved.

These are the famous final words of the *Origin* (Chapter 14, p. 490). An overall theme of the book, but one especially prominent here, is the appearance of unexpected kinds of order from a diverse mass of local interactions. Rosalind Page's piece expresses this idea; it begins with a number of self-contained short themes dispersed throughout the ensemble, and those are drawn together into a single structure as the piece develops.

The composer comments that the piece was also inspired by "Darwin's visit to the Galapagos island of Floreana in 1835, during which, it seems, he first noticed changes in the mockingbirds (known as the "Floreana" or "Charles" Mockingbird, *Mimus trifasciatus*) significantly different to those elsewhere. The concluding bars feature a transcription for piccolo of recent field recordings of the song of the Charles Mockingbird, now sadly extinct on Floreana and listed as Critically Endangered. It is not unreasonable to suppose that this natural song cycle caught Darwin's attention."

Peter Godfrey-Smith and Jane Sheldon, 2009