Natural Representation: Diagram and Text in Darwin's On the Origin of Species

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Natural Representation: 
Diagram and Text in Darwin’s On the Origin of Species

Heather Brink-Roby

In On the Origin of Species (1859), when Darwin turns to the action of divergence, combined with that of natural selection and extinction, he opens his discussion in the manner of a Euclidean proof: “The accompanying diagram will aid us in understanding this rather perplexing subject. Let A to L represent the species of a genus large in its own country . . . ” (1st ed. 116) (fig. 1). In the geometrical tradition, the logical relationship between such a written proof (“Let AB represent the greater of two lines . . . ”) and the coincident diagram is well established (fig. 2). Reasoning takes place and conclusions are reached in the text; diagrams—which merely clarify and provide specific examples for the text—are fundamentally “auxiliaries . . . not essentially necessary” (Upham 360; see also Cooley 12; Stewart 86–87).

Given that Darwin formulates his discussion in the style of a geometric proof, it is tempting to assume that he assigns text and diagram the roles stipulated in that tradition. However, Darwin insisted that his figure was no mere auxiliary to his written argument; “the Diagram . . . is an odd looking affair,” he wrote to his publisher John Murray in 1859, “but is indispensable to show the nature of the very complex affinities of past & present animals” (Correspondence 7: 300). Darwin’s remark that the diagram looks “odd” suggests that he believed Murray would find it unfamiliar—that it was, therefore, a departure from conventional natural history images. But Darwin warned against assuming it was “odd” in another sense of the word, that of extraneous, additional, or dispens-
able. If this warning was more than an effort to preempt publisher resistance—if Darwin introduced geometry’s emphasis on the relative roles of diagram and text without adopting the stipulated roles themselves—how did the nineteenth century’s most influential naturalist conceptualize the functions of his media?

Drawing on evidence from his barnacle monograph, letters, reading notebooks, theoretical notebooks, sketches, and loose notes,

**Fig. 1.** Diagram and text in *On the Origin of Species by Means of Natural Selection, or the Preservation of Favoured Races in the Struggle for Life*, by Charles Darwin. London: John Murray, 1859. From the collections of the Ernst Mayr Library, Museum of Comparative Zoology, Harvard University.

**Fig. 2.** Geometrical proof from Horatio Robinson’s textbook, *Elements of Geometry, and Plane and Spherical Trigonometry*, New York: Ivison, 1860: 47. Special Collections, Monroe C. Gutman Library, Harvard Graduate School of Education.
this article answers that question with recourse to three aspects of Darwin’s argument in the *Origin*: natural relations, time, and extinction. As we will see, text and image do not each play a consistent, single role in his work; their uses and interactions vary depending on the argument in question. I first examine the challenges of representing complex natural relations in linear written text, challenges that drove demand for diagrams. Although Darwin emphasizes the superiority of two-dimensional diagrams in this regard, he suggests that even they are unable to capture adequately both the complexity of natural relations and the element of time. While he experiments with other strategies for negotiating this trade-off in his earlier radial sketches, in the *Origin* diagram Darwin assigns time the vertical axis, introducing this translation of time into space using the sequential quality of language and naturalizing the translation through the idea of geological strata. Darwin then exploits the overall shortage of representational dimensions in his discussion of extinction, even as he gives himself access to an additional dimension through the “Tree of Life” metaphor (1st ed. 130). Ultimately, I suggest, understanding the roles of text and image takes us back to the late 1830s when Darwin began to consider “metaphysical” support for his theory (*Notebooks* 7–8), studying ideas about the origin of language, perception, consciousness, intelligence, taste, expression, and instinct. As part of these studies, he sought to understand the significance of representation in evolution by natural selection, a significance that allowed the use of image and word not simply to argue for, but as evidence of, his theory.

**Natural Relations and Language**

Darwin included only one figure in *On the Origin of Species*, a fact that seems to make the book an unpromising subject for an analysis of the roles and relations of image and text. My focus appears particularly perverse in the context of Darwin’s other works and natural history monographs more generally; the coexistence and interpenetration of image and text was a key feature of nineteenth-century culture, and natural history publications were a primary locus of this phenomenon (Blum; Elkins; Smith; Thomas). The *Origin*’s unusual dearth of images can be explained, perhaps, by its status as an “abstract” (*Origin*, 1st ed. 1–2; *Correspondence* 7: 269). In the rush to press following A. R. Wallace’s rival formulation of evolution by natural selection,
Darwin saved supporting materials, including references and illustrations (pictorial and textual), for a more extensive future book.²

To understand why his inclusion of the *Origin* diagram was not an exception to this practice, we can first turn to Darwin’s work on barnacles. Five years before publication of the *Origin*, in the volume of his *Monograph on the Sub-Class Cirripedia* (1854) devoted to living sessile barnacles, he had introduced a representational need for images by highlighting text’s failure to depict affinities between organisms. Darwin groups barnacle species into “sections” titled A through F and describes the sections in alphabetical order. He notes, “The arrangement of the species is, I think, as natural as a linear one could be made: every one knows how irregularly and in how many directions the lines of affinity in every natural genus branch out” (191). Darwin then identifies specific ways in which his “linear” method fails to capture affinities as they exist in nature:

Some few species stand rather isolated, as *B. declivis*; and *B. allium, cepa*, and *quadrivitatus* in a little group by themselves. . . . The species in the first and second sections (A and B) blend into each other; and . . . the blending species are likewise allied to some in the last section (F); furthermore, I shall have occasion to show that these same species can hardly be separated naturally from the sub-genus Acasta. The first section, moreover, passes into the third (C) by *B. tulipiformis*; and the third into the fourth (D) by *B. improvisus, nubilus, corrugatus*, and *patellaris*: the fifth and sixth (E and F) sections are closely connected together by *B. cariosus and flosculus*; and these two sections blend into the fourth (D) through *B. unguiformis* and *balanoides*, and lastly, into the third (C) section by *B. dolosus* and *improvisus*. (191)

The nonsequential arrangement of the bracketed letters in the text—“(A and B)” is followed by “(F),” not “(C)”—allows Darwin to underscore the inadequacy of the linear series (A through F) upon which his barnacle book is organized. At the same time, however, this new arrangement is itself unavoidably linear (A, B, F, etc.) within the text. More generally, if Darwin’s convoluted description highlights the limits of his linear arrangement, it also suggests—as much as actual information about species relationships—the difficulty of overcoming these limits within language.

Darwin was not the first to feel the limitations of linear series for depicting natural relations. The geologist and zoologist Hugh Edwin Strickland wrote in an 1841 article, “Some naturalists have attempted to place all animal species in a straight line, descending from man to a monad. This theory assumes that each species (excepting the two extremes) has two and only two direct affinities; one, namely, with the
species which precedes, and the other with that which follows it” (186). In this case, Strickland notes in his text, “B A C D” adequately represents the relations between four species (189). However, Strickland and a growing number of other naturalists were recognizing “the existence in many cases of more than two direct affinities” (186). To represent this type of relation, Strickland interrupts his text with a branched diagram:

\[
\begin{array}{c}
B \\
\quad \\
\quad \\
\quad \\
E \\
\end{array} -- \begin{array}{c}
A \\
C \\
D \\
\
\end{array}
\]

Underscoring his inability to represent natural relations in written language, he asserts, “The true order of affinities can only be exhibited (if at all) by a pictorial representation on a surface” (192, emphasis original). The transition from linear models (such as the great chain of being) to branched or webbed models of nature makes a “chain of words” a problematic form of representation.³

Darwin was familiar with Strickland’s work; indeed, in 1844 Darwin instructed his wife that, in the event of his premature death, Strickland would be the fifth best person to edit a draft of the evolutionary theory and see it to press (F. Darwin 17). Darwin read Strickland’s 1841 article, in particular, in the year it appeared (Bredekamp 33) and took interest in the argument that diagrams alone—“maps,” to use Strickland’s term—could represent natural relations. He wrote on the front cover of his copy of John Lindley’s A Natural System of Botany (1836), “Does not Lindley use Diagrams to represent affinities, like the maps of Strickland?” (Di Gregorio 501). The comma suggests Darwin was concerned not with the particular nature of the diagrams, but rather with Lindley’s implicit claim, consonant with Strickland, that diagrams are required.

It is important to recognize, however, which understanding of the natural system Strickland’s branched arrangement (which drove his need for diagrams) was based on. “We define the natural system,” he writes, “to be the arrangement of species according to the degree of resemblance in their essential characters” (184, emphasis original). Lines of “affinity” represent similarities in morphology (Mayr 43, 209). While Strickland claims that such affinities reveal the divine plan of the Creator (Jardine 350), Darwin argues in the Origin that similarities (barring those that result from convergent evolution) are “due to inheritance or community of descent” (Origin, 1st ed. 479). He embraces
Strickland’s observation, echoed in the barnacle monograph, that morphological affinities are nonlinear, but he gives this observation a new explanation: species have morphologically radiated from their common ancestors (430–34).

The alleged cause of the Strickland-style system—community of descent—becomes the primary focus of Darwin’s. His natural system is likewise branched but has a very different explanation: “on the view which I hold, the natural system is genealogical in its arrangement, like a pedigree” (Origin, 1st ed. 422; see also Ghiselin 83; Ospovat 171; Ritvo 31). The Origin diagram depicts this pedigree-like arrangement (fig. 3). The capital letters (A) through (L) represent classes descended from an unknown common parent (124); fanning dotted lines reaching upward from these letters represent varying offspring groups, some of which themselves give rise to varying groups, on through to the 14,000th generation. Thus, unlike a family pedigree, which represents individual humans sexually reproducing, Darwin’s diagram shows groups splitting, continuing to diverge morphologically, and splitting again.

The Origin’s famous closing paragraph gestures to these branched relationships between groups while implicitly noting the limitation of language in their representation:

It is interesting to contemplate an entangled bank, clothed with many plants of many kinds, with birds singing on the bushes, with various insects flitting about, and with worms crawling through the damp earth, and to reflect 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. (489)

The “complex” ecological and physical relations evoke the organisms’ equally intricate genealogical relations, an evocation buttressed by Darwin’s use of “entangled.” “Tangle”—the root of “entangle”—originally meant a type of seaweed (Laminaria digitata or L. saccharina), and on one of his early manuscript “Tree of Life” diagrams, sketched on loose sheets of paper, Darwin writes, “Tree not good simile—endless piece of seaweed dividing” (qtd. in Gruber 127). But if Darwin was interested in the complex relationships among groups on the “entangled bank,” his sentence’s very structure suggests irrelativeness underlies difference. The grammatical parallelism of the passage compartmentalizes the organisms, leaving the reader with discrete and sequential clothing plants, singing birds, flying insects, and crawling worms: a
configuration that undercuts any assertion of complex relations among them.

Written language’s inability to represent such complex, branched natural relations—an inability suggested in practice—is confirmed in metaphor. Elaborately likening the fossil record to a written historical narrative composed in an evolving dialect, Darwin writes,

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, but widely separated, formations. (Origin, 1st ed. 310-11)

As Stephen Alter notes in passing, this paragraph “suggested unilinear rather than branching development” (24). The metaphorical book records, if imperfectly, the linear evolution of the hypothetical dialect. Even in his metaphors, then, Darwin allies text with linearity, refusing to represent the idea of branching evolution through that of written words. Indeed, he does so despite the risk that readers might reasonably assume he is positing linear development.

Dimensionality and the Limits of Diagrams

The Origin diagram’s horizontal lines highlight this one-dimensional quality of the text on the page beside it, emphasizing the words’ formal inability to represent more complex relations (fig. 1). At the same time, the obvious fact that the diagram is printed separately on different paper, and the fact that it (in Darwin’s words) unfolds “clean out” of the book, underscores the image’s ability to flout the text’s constraints and limitations (Correspondence 7: 300, emphasis original). Darwin concludes in his chapter on “Classification”:

As it is difficult to show the blood-relationship between the numerous kindred of any ancient and noble family, even by the aid of a genealogical tree, and almost impossible to do this without this aid, we can understand the extraordinary difficulty which naturalists have experienced in describing, without the aid of a diagram, the various affinities which they perceive between the many living and extinct members of the same great natural class. (Origin, 1st ed. 431)
The term “affinity” is tellingly multivalent; as we have seen, Darwin is interested in revealing the connection between the word’s natural historical sense of “morphological similarity” and its older meaning of “propinquity of descent” (413). He suggests both types of complex relations can best be represented in a diagram, a form relatively free from the limitations of the implicit default medium of language.

But if diagrams were necessary to represent natural relations, they were not considered panaceas; they were recognized to have representational limitations dictated, as in the case of language, by their formal qualities. As previously discussed, Strickland argued in his 1841 essay for the superiority of two-dimensional “maps” of species affinities. The cartographic term was meant to suggest that he was representing complex, three-dimensional affinities in a two-dimensional plane (as in the case of geographic maps) (190). But Strickland expressed doubt that even this method was adequate to represent natural affinities:

Whether they are so simple as to admit of being correctly depicted on a plane surface, or whether, as is more probable, they assume the form of an irregular solid, it is premature to decide. They may even be of so complicated a nature that they cannot be correctly expressed by terms of space, but are like those algebraical formulæ which are beyond the powers of the geometer to depict. (190)

Strickland wonders, in other words, if the natural system can be represented only in more than three dimensions.

Darwin similarly highlights the limitations of his Origin diagram. The “natural arrangement is shown,” he writes, “as far as is possible on paper, in the diagram, but in much too simple a manner” (1st ed. 422), suggesting (following Strickland) that the planar surface of paper is itself a limiting factor. “If a branching diagram had not been used,” Darwin continues, “and only the names of the groups had been written in a linear series, it would have been still less possible to have given a natural arrangement; and it is notoriously not possible to represent in a series, on a flat surface, the affinities which we discover in nature amongst the beings of the same group” (422). To understand why the diagram is hampered by the very physical material on which it is portrayed, we can consider the figure’s representation of synchronic similarities between organisms. Darwin suggests that the horizontal axis represents morphology, the vertical axis time (116–17). Thus, the morphological arrangement of extant groups at any given time is found by taking a horizontal slice of the diagram. This process yields a linear series of dots:
(focusing on a moment during the 8,000th generation, for example). In one way, this result works with Darwin’s argument; the absence of synchronic lines of relation emphasizes that true relations exist only diachronically. We must recognize, however, that this linear arrangement simultaneously suggests simple chain-like morphological affinities between extant groups of organisms.

Of course, there are different degrees of affinity within this chain. Taking as another example the case at the 14,000th generation, if each letter on the diagram’s uppermost line represents a genus including several species (412), the three left-most genera ($a^{14}$ through $b^{14}$) have morphologically radiated from $a^{10}$; likewise, $b^{14}$ and $f^{14}$ have recently radiated from $f^{10}$; $a^{10}$ and $f^{10}$ are themselves the products of lines that have radiated from their common ancestor $a^5$. The result should be, as Darwin highlights, points that are “clustered round points, and these round other points, and so on in almost endless cycles” (129). However, Darwin’s Origin diagram lacks the necessary second dimension of morphology to represent these cycles of affinity; variation occurs along only the horizontal axis, and the system of points is linear. If On the Origin of Species (as a book) nonetheless captures such cycles of affinities, it does so by supplementing the diagram’s linear arrangement with a textual description. Language acts as the diagram’s needed third dimension. Darwin explicitly notes in the Origin’s sixth edition, “The representation of the groups, as here given in the diagram on a flat surface, is much too simple. The branches ought to have diverged in all directions” (370). After all, if branches extended into the third dimension, a synchronic horizontal slice or a diachronic view down the vertical axis could reveal nonlinear similarities.

Darwin had experimented on a loose sheet of paper, sometime between 1851 and 1857, with a different means of capturing the element of time and the results of modification (fig. 4). As Horst Bredekamp notes (34), the inscription at the origin (“Parent of Marsupials & Placentalia”) is written vertically, indicating that the view can be rotated around the center and that the circle-segment is imagined as part of a complete circle. This figure and another (fig. 6) were apparently based on the frontispiece of Jean Louis Rodolphe Agassiz’s 1848 Principles of Zoology (fig. 5), which was in Darwin’s library (Voss 143–45). Agassiz’s image is of a globe cross-section with an isolated central point of creation surrounded by symbols of the four divisions of nature; fossil deposits of species extend outward through the sediment. Time radiates from a
point, instead of being the vertical dimension of the two-dimensional page (as in the *Origin* diagram). Darwin’s sketches assume this basic structure, but classes are connected by genealogical branches. Following Agassiz, Darwin uses the period terms “Palæoz\[oic\],” “Second\[ary\],” and “Tertiary” (fig. 6) to label his hastily drawn concentric rings (which replace the horizontal generational lines of the *Origin* diagram). The arrangement of groups at any one time is a series of points on the circumference of a circle.5

Closer examination of figure 6 reveals, however, a potential contradiction. Specifically, the central ur-branch’s southwest pointing
sub-branch leaves the “Secondary” time ring (which its parent had already entered), thereby moving backward in time (Bredekamp 38; see arrow in fig. 6). Darwin may have been drawing in three dimensions, intending the branch to project below the plane of the page; after all, his original branching sketches in Notebook B were based on three-dimensional coral (Notebooks 177), and Agassiz’s globe diagram implies three dimensions. However, the contradiction may alternatively signal that Darwin is introducing another understanding of his Agassiz-style framework. If Darwin dedicates both dimensions of the page to morphology, such a backtracking branch is unproblematic. Organisms still radiate gradually from centers; however, this radial dispersion is a function not of time’s radiation from a point (as in Agassiz’s image) but of morpho-
logical divergence in all directions from a common parent. The circular arrangement is relational, not merely a representational artifact. And this alteration allows the structure of cycles within cycles that is absent from the *Origin* diagram; if all branches diverged in a whorl-like fashion, and the bases of branches died, then one would indeed be left with points that are “clustered round points, and these round other points,” as Darwin notes in the *Origin*.

Given this alternative understanding of figure 6, time is then captured indirectly in a manner related to that used in Darwin’s later volumes, *On the Movements and Habits of Climbing Plants* (1865) and *The Power of Movement in Plants* (1880) (fig. 7); there, a plant’s position can be given by \((x, y)\), where \(x\) and \(y\) both measure physical displacement from the origin but are themselves dependent on the parameter \(t\) (time). Likewise, in figure 6 the position of a given branch’s growth tip can be given by two morphological variables, which are themselves...
dependent on time. The problem, of course, is that this depiction makes it difficult to track the rate of change, or to identify morphological affinities between groups at a given time. The very fact that both dimensions are occupied by morphology makes time an invisible element. This difficulty helps explain why Darwin did not pursue this method in the *Origin*.

But if these circular sketches, with their tensely wedded conceptualizations, created problems for Darwin, it seems they had an advantage even more important than their ability to capture cycles of affinities. Darwin concisely articulated in Notebook B, “It is absurd to talk of one animal being higher than another.— We consider those, where the intellectual faculties (cerebral structure) most developed, as highest.— A bee doubtless would [consider those animals as highest] when the instincts were [most developed]” (Notebooks 189, emphasis original). Given this rejection of the idea that more recently evolved forms are “higher,” the *Origin* diagram seems problematic; while morphological change occurs horizontally, and a group that is extant at the 14,000th generation appears at the top of the page (no matter when that group arose), the overall movement is literally from lower to higher on the page. Darwin’s sketches (figs. 4 and 6) escape this problem, portraying evolution not as upward progression but as radiation from a center.

In the *Origin*, however, Darwin cautiously argues that his theory does, in fact, recognize and explain a development from lower to higher organisms:

> There has been much discussion whether recent forms are more highly developed than ancient. I will not here enter on this subject, for naturalists have not as yet defined to each other’s satisfaction what is meant by high and low forms. But in one particular sense the more recent forms must, on my theory, be higher than...
the more ancient; for each new species is formed by having had some advantage in the struggle for life over other and preceding forms. (336–37)

Recent organisms are higher in the sense that they are better adapted to their “conditions of life” and have succeeded over their immediate predecessors. By the Origin’s third edition, Darwin asserts that natural selection can explain not only such competitive highness but also organizational highness (specialization and division of physiological labor) (3rd ed. 363–64). Thus, while he rejects the idea of innate or necessary progress, he underscores natural selection’s powerful ability to drive improvement and advancement in the natural world (Gould; Marks; Ospovat; Richards; Ruse): an ability conveyed in the upward progression of the Origin diagram.

Time, History, and Process

But how does one know, in the first place, that the Origin diagram should be read from bottom to top? In the chapter where Darwin introduces his figure, he methodically describes the evolutionary scenario it depicts. Beginning with species (A) through (L), Darwin then focuses on (A). He traces the descent of (A) first through variety \(a^1\) and then through variety \(m^1\). Then, he traces variety \(a^1\) to \(a^2\) and, subsequently, variety \(m^1\) first to variety \(m^2\) and then to variety \(s^2\). That is, he is forced in the text to describe individual lines of descent; starting from a fork in the tree, he follows a given branch up to a certain moment in time, then begins again at the fork and traces a different branch. This procedure formally presents the branches as in series, rather than as diverging, all importantly, from a common origin. But if Darwin loses the diagram’s branching character—its groups becoming linked in a linear series—he simultaneously establishes a sequential way of reading his figure. He writes at the end of his variety-by-variety linear description, “We may continue the process by similar steps for any length of time” (1st ed. 118), where the time in question is both the evolutionary time in which new varieties emerge and the textual time in which Darwin describes them. If written language posed problems in the representation of complex natural relations, it was uniquely suited to capture time and process.

This sequential and temporal quality of written language found its definitive formulation in Gotthold Ephraim Lessing’s Laocoon: or the Limits of Poetry and Painting (1766), which Darwin read in translation in
1838 (noting at the head of the list of books and articles that includes Lessing’s work, “N.B. These books have been read since I thought of my transmutation theory” [Correspondence 4: 454, 456]). While Darwin apparently consulted the Laocoon because of its treatment of emotion, the primary claim of Lessing’s work was that visual and linguistic representation are suited to the depiction of different subjects. Images are suited to display space, simultaneity, and stasis, while poetry and other forms that rely on the sequential linguistic sign are suited to the depiction of time, history, and process.8 Providing an example of this latter subject-medium homology, Lessing writes that, to delineate the “bow of Pandarus,” Homer “begins with the chase [sic] of the wild goat, out of whose horns the bow was made. Pandarus himself had laid in wait for and killed it among the rocks; its horns were of an extraordinary size, and, for that reason, were destined to be turned into a bow. Then comes their manufacture; the artist joins them, polishes them, and tips them” (109–10). Thus, “in the poet we see the origin and formation of that, which we only see as a completed object in painting” (110).

Darwin was, of course, concerned with questions of origin and formation, with questions of history: the “history of the organic world” (Origin, 1st ed. 106). In the conclusion to the Origin, he writes,

> When we no longer look at an organic being as a savage looks at a ship, as at something wholly beyond his comprehension; when we regard every production of nature as one which has had a history; when we contemplate every complex structure and instinct as the summing up of many contrivances, each useful to the possessor, nearly in the same way as when we look at any great mechanical invention as the summing up of the labour, the experience, the reason, and even the blunders of numerous workmen; when we thus view each organic being, how far more interesting, I speak from experience, will the study of natural history become! (485–86)

The naturalist must focus on progressive construction, must see “every complex structure and instinct” as—like Lessing’s bow—“the summing up of many contrivances.” Of course, this mechanical-invention metaphor problematically suggests that organisms are the product of design and agency; Darwin risks potential misunderstandings of his argument simply to highlight that organisms (like built objects) have a history of formation.

As we saw in the opening of this section, to capture such temporal processes Darwin relies on the sequential nature of text, even using it to introduce time into his diagram. But (as that example also suggests)
Darwin did not accept the Lessingian implication that, while natural history in the traditional, ahistorical sense should depend on the visual arts, Darwin’s newly historical natural history must rely exclusively on writing. In fact, beginning early in Darwin’s career, he often depicted process in images. As S. S. Schweber writes, “Looking over Darwin’s early notebooks dating from the voyage of the Beagle, one is struck by the fact that the pictures he drew were not concerned with momentary reality: they were drawn to exhibit change. It is as if when looking at geological phenomena Darwin only saw how the features came to be the way they are” (47, emphasis original). For example, in Darwin’s Red Notebook, his sketches of tidal action on coastlines (fig. 8) and the formation of spherical hollow concretions on Chiloé (fig. 9) focus on change over time.

But while in early private notebooks Darwin unhesitatingly uses images to represent transformation and process, in his public
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Origin diagram he takes pains to underscore that he is depicting time and historical change. Most notably, he includes horizontal generational lines, which he had not used in the inverted, top-to-bottom drafts of the Origin diagram that appear in his manuscript “big species book” (of which the Origin was an abstract). To modern eyes, these temporal lines might seem to be a convention borrowed from graphs: a reasonable conjecture given that the graphical tradition had made commonplace the visual representation of time. William Playfair writes in the first edition of his graphically revolutionary Commercial and Political Atlas (1786), “As to the propriety and justness of representing sums of money, and time, by parts of space, tho’ very readily agreed to by most men, yet . . . a few seem to apprehend that there may possibly be some deception in it” (Playfair iii; see also Wainer 5). By the 1850s, such skeptics were no longer numerous enough to require acknowledgement. The graphical representation of time, which relies on an analogy between parts of time and parts of space, was established.

But Darwin’s diagrammatic representation of time in the Origin does not likewise rely on a space-time analogy. “In the diagram,” he writes, “each horizontal line has hitherto been supposed to represent a thousand generations, but each may represent a million or hundred million generations, and likewise a section of the successive strata of the earth’s crust including extinct remains” (1st ed. 124). Like the column below Agassiz’s globe figure (fig. 5), the diagram shows a physical cross-section of the earth’s crust. Darwin pictorially represents strata and thereby time. After all (as the casualness of his generation-stratum substitution reminds us), these geological strata are themselves time naturally translated into space.

Overcoming and Exploiting Limitations

Even given this natural translatability, the fact that the horizontal lines may represent a thousand, million, or hundred million generations—or a section of geological strata—reminds us of the powerful multivocality of images. Of course, text alone isolates these four meanings from a profusion of possible significations. And if Darwin uses language to control the fecundity of his diagram, indicating what a given element means, we might expect that he would also use text to signal which elements even carry theoretically significant meanings. He does so, only to reject the distinction between artifact and meaningful information, in his discussion of extinction.

While extinction was central to Darwin’s theory, the phenomenon presented certain argumentative challenges: “the fact of extinction is hard to prove, since it is founded on negative evidence—that is, the failure up to a particular moment in scientific time to find living specimens of an organism known to have once lived” (Gruber 126). Darwin solves this difficulty by granting significance to what he initially identifies as a product of the limitations of his diagram. In his explanation, after following the progression of (A) and (i) from the base of the diagram through their various branchings to the 14,000th generation, he highlights that the “other nine species (marked by capital letters) of our original genus, may for a long period continue transmitting unaltered descendants; and this is shown in the diagram by the dotted lines not prolonged far upwards from want of space” (1st ed. 121). Initially, then, these species are understood to continue to pass upward, unaltered. The diagram does not represent this continuation (the dotted lines break off) simply because of “want of space.”

Almost immediately, however, Darwin grants meaning to this artifact of representation. He continues, “But during the process of modification, represented in the diagram, another of our principles, namely that of extinction, will have played an important part” (121). “It seems to me extremely probable,” he writes of the modified descendants of (A) and (I) in the 14,000th generation, “that they will have taken the places of, and thus exterminated, not only their parents (A) and (I), but likewise some of the original species which were most nearly related to their parents” (122). In fact, by the 14,000th generation the other nine original species have “all become, excepting (F), extinct, and have left no descendants” (123). In the case of his radial sketches, Darwin ulti-
mately grants relational meaning to the circular configuration that was initially an artifact of depicting time as radiating from a point. Here, he gives significance to the representation that only one of the eleven original species persists up to the top of the diagram.9

Francis Bowen’s anonymous 1860 review of the *Origin* highlights the latent theoretical fruitfulness of the formal constraint—the “want of space”—that yields this sometime representational artifact. Bowen, a Harvard philosophy professor, describes the diagram as “closely resembling in shape an open fan, though most of the sticks are broken off at different lengths. At many points on each stick, little secondary fans branch out, and from these, again, a third set radiate, and so on indefinitely” (Bowen 481–82). He explains, “Millions of developing stocks are thus constantly aiming to push out their divergent lines of offspring over the same ground, and wherever they cross each other, a battle for life ensues, in which the stronger, the better armed, or the more prolific combatant, or the one better adapted to the locality, necessarily triumphs, and its rival perishes” (482). The reviewer moves effortlessly from describing the diagram to describing the natural world. The word “line”—line of descent, printed line—allows this movement, as does “ground.” The latter suggests both the surface of an image and terrain or natural habitat; sticks crossing on the bounded page become rival organisms battling over limited territory. In other words, the reviewer highlights the implicit link between the diagram’s finite “ground” and Darwin’s metaphor of an evolutionary “struggle for existence”: a metaphor that itself draws on the familiar notion of rivals battling for scarce resources to capture a variety of relationships that yield the survival and reproduction of some organisms and the ultimate extinction of others (*Origin*, 1st ed. 62–63; see also Gould 470).

Ultimately, however, Darwin’s phrase “want of space” refers not simply to the helpfully finite page size but also to the diagram’s two-dimensional surface. In a three-dimensional diagram, branches—when crowded—could simply extend in another dimension. Thus if, as we earlier saw, the limited number of available dimensions worked against Darwin’s claim for complex, radiating affinities between organisms, he exploits this same constraint to argue for extinction.

But having established that limited dimensions are important to Darwin’s argument for extinction, it is worth considering whether he simultaneously escapes that limitedness with regard to natural relations. He famously writes, “The affinities of all the beings of the same
class have sometimes been represented by a great tree. I believe this simile largely speaks the truth” (*Origin*, 1st ed. 129). He then deploys the simile in transmutationist terms:

The green and budding twigs may represent existing species; and those produced during each former year may represent the long succession of extinct species. . . . The limbs divided into great branches, and these into lesser and lesser branches, were themselves once, when the tree was small, budding twigs. . . . As we here and there see a thin straggling branch springing from a fork low down in a tree, and which by some chance has been favoured and is still alive on its summit, so we occasionally see an animal like the Ornithorhynchus or Lepidosiren. . . . As buds give rise by growth to fresh buds, and these, if vigorous, branch out and overtop on all sides many a feeble branch, so by generation I believe it has been with the great Tree of Life. (1st ed. 129–30)

Even as he uses the tree as a metaphorical vehicle, Darwin focuses on it as a physical object, suggesting that the reader visualize it (“we here and there see a thin straggling branch”) in three-dimensional space. This metaphoric tree must not be conflated with the *Origin* diagram but, by organizing that branching diagram from bottom to top, Darwin allows resonance between the two figures (metaphor and diagram), providing a model by which to imaginatively extend the diagram’s branches into and out of the page.

Implicit in this reading is the suggestion that Darwin depicts multi-dimensionality and—despite his claims—its attendant potential for complex relations in language itself. And if Darwin escapes written text’s one-dimensionality by encouraging his reader mentally to picture the “Tree of Life,” there is perhaps a second way in which that metaphor allows him to introduce multi-dimensionality to language. “Metaphor,” W. Bedell Stanford wrote in 1936, “is the stereoscope of ideas. By presenting two different points of view on one idea, it gives the illusion and conviction of solidity and reality. Thus metaphor adds a new dimension to language” (105). Stanford’s own metaphor is significant. Stereopsis was first described by Charles Wheatstone in 1838, and there was widespread fascination with his demonstration that humans’ impressions of three-dimensionality are created by the mental combination of images taken from different points of view. Darwin himself was intrigued by these advances (*Correspondence* 7: 81). If, as contemporary writers claimed, metaphor similarly uses multiple “points of view” to create “depth,” then it likewise escapes the dimensional limits of its medium, evoking multi-dimensionality for the reader.10
Conclusion

We can return, in closing, to our opening observation that the *Origin* has only one diagram. Martin Rudwick argues for the critical advantages of such a paucity of images; when cost or other constraints prevented authors from including many figures, sometimes allowing them only a frontispiece, the solitary image functions as a “visual summary of what the author and/or the publisher considered most important about the book” (Rudwick 154). Indeed, Darwin’s choice to include only one image surely grants his diagram significant visual weight. But one should recognize, in Rudwick’s remark, the implicit suggestion that images serve only for emphasis: that the information they contain is already present in the book, and that they function simply to clarify and summarize. For Darwin, as we have seen, this was not the case. Rather, various media were suited to display different types of information, and no medium was without its challenges. I have focused on these representational opportunities and obstacles in his discussion of natural relations, extinction, and time, exploring how Darwin selectively employed and manipulated his media to capture these three foci of his theory. The uses and interaction of text and image vary, even within the *Origin*, depending on the argument in question. The continuity resides, instead, in Darwin’s intricate negotiation between his argument and the media in which it is presented.

Darwin’s first recorded interest in this subject-medium relationship is from the late 1830s, immediately after he developed his theory of evolution. During this period, he took notes on consciousness, perception, taste, and—most importantly—representation, as they relate to evolution by natural selection. Darwin writes in Notebook N, the second notebook on “metaphysical enquiries” (*Notebooks* 561), kept in 1838–39, “In language. the possibility of poets describing gentle things in gentle language, & vice versa.—almost proves that at earliest times there must have been intimate connection between sound & language.—” (*Notebooks* 571, emphasis original). The fact that the qualities of words can capture those words’ meanings supports Darwin’s theory because it suggests that language developed from more primitive, imitative behavior. In a later passage from the same notebook, Darwin examines Hensleigh Wedgwood’s claim that in “numerous lines” of Edmund Spenser and Gavin Douglas’s poetry, “signs- sounds singularly adapted to subject.” Darwin concludes, “I think this argument might be used to show language had a
beginning, which my theory requires” (Notebooks 574). Signs’ and sounds’ suitability to their subject becomes meaningful for Darwin, supporting his evolutionary claims. By extension, Darwin’s own use of language became theoretically loaded; language, when employed in such a way that form reflects content, provides meta-evidence for his evolutionary argument. Signs can be used not only to explain his theory, but also as second-order proof of that theory.

It is interesting to consider whether these consequences were limited to language; the alliance of other highly developed representational forms to their content could potentially support an evolutionary argument that claimed such abstract practices were based in primitive imitation. While Wedgwood provided examples of “signs’ sounds singularly adapted to subject,” Lessing, Strickland, and others went a step further, claiming that a given medium was, by its nature, suited to capture some objects or ideas and not others.

However, if for the authors Darwin read the medium is overwhelmingly prescriptive—the sign dictates what can be said—for Darwin himself there is flexibility in the way a given subject is allied with its medium. Deftly manipulating and creating interplay between image and text, he escapes the perceived constraints of his media while still insisting on the natural, organic quality of representation. If scholars have sometimes wondered whether Darwin’s arguments engendered correspondingly innovative methods of representation, he was—as we have seen—startlingly creative in this pursuit of natural representation.

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NOTES

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1 Darwin highlighted geometry’s importance to his intellectual education (Autobiography 43, 59).

2 A survey of Darwin’s use of “illustration” suggests that he employed the term primarily to signify a function (namely, providing an elucidating example) rather than a medium. Darwin never published the “big species book” from which the Origin was drawn, but much of the material appeared in Variation of Animals and Plants under Domestication (1868), The Descent of Man, and Selection in Relation to Sex (1871), and The Expression of the Emotions in Man and Animals (1872).

3 For contemporary examples of this telling phrase, see Folsom 2; Livermore 155; Pybus 246. On the chain of being, see, for example, Bowler, Fossils and Evolution; Ritvo. This concern with the limitations of language as a linear system has continued in modern
systematics (McKenna and Bell 499–500; Simpson 295–96). Julia Voss notes another cause of the rejection of language to represent natural relations: the recognition that names are arbitrary (and thus do not capture the essence or organization of things) (114–15).

Darwin may have heard “tangle” in this original sense while a student in Edinburgh; Robert Greville writes in *Algæ Britannicæ* (1830) of *L. digitata*, “In Scotland, where the tender stalks of the young fronds are eaten, and still cried about the streets of Edinburgh, it is called *Tangle*” (29, emphasis original).

The left edge of figure 4 reads, “If these had all given descendants then there would have been a great series.” Instead, due to extinction there is a large gap in the series of forms along the outer ring. The upper edge reads, “Let dots represent Genera???” Darwin writes at the top of figure 6, “Dot means new form—say in Birds.”

Figure 7 shows the circumnutating movement of the crown of a buried and arched *Brassica oleracea* hypocotyl. At short intervals of time, position was registered with a dot on a horizontal glass; dots were then joined by straight lines. A broken line represents a nocturnal course.

In Darwin’s sketches of the “coral of life” (*Notebooks* 177), he likewise represents time indirectly.

While Lessing discussed painting and poetry explicitly because they were the “sister arts” whose likeness he was rejecting, he made clear that the signs themselves—successive articulate sounds, or forms and colors juxtaposed in space—dictated what a given medium was suited to represent; thus, poetry and painting were “synecdoches for the entire range of temporal and spatial signification” (Mitchell 48–50, 95).

Wallace, who promoted Strickland’s methods, wrote that every systematic work should include diagrams, “without which it is often impossible to tell whether two families follow each other because the author thinks them allied, or merely because the exigencies of a consecutive series compels him so to place them” (207). In essence, Wallace claims that without diagrams the reader cannot know whether information is meaningful or is simply a product of the representational medium’s limitations; Darwin capitalizes on this basic ambiguity within his diagram itself.

For metaphor as a way of capturing multiple “points of view,” see “Sydney Smith’s” 389; “Conversations” 162; Bloomfield 311. For the role of “different points of view” in the stereoscope, see “The Stereoscope” 40; “Binocular Vision” 470; “Stereoscope” 659. For the stereoscope as a figure for literary technique, see Rev. of *John Halifax* 504.

**WORKS CITED**


Rev. of *John Halifax, Dublin University Magazine* 48 (1856): 503–04.


