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Style, Philosophy, and Scientific Writing

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In 1972 Myrna Gopnick's study, *Linguistic Structures in Scientific Texts*, was published in Paris. It concerned itself with materials "selected at random from the Proceedings of the Federation of American Societies for Experimental Biology." But FASEB itself was not "selected at random." Rather, Mrs. Gopnik announced a "primary" and a "second strong requirement" that this material satisfied, to wit, "that the texts concerned be as free as possible from stylistic variation," and "that the semantic content of the texts be as explicitly stated as possible and as free from outside references as possible." Within the terms of her study, she explains, "what is interesting" about a text is "not the particular set of transformations which generated" it, but "the information which is carried by these transformations." She concedes, in a footnote, that "this assumption would not hold true" for literary texts. ¹

Not enough is said of "literary texts" to make them more than a passing foil for "scientific texts," and it is the latter which are of present concern. Mrs. Gopnik's scientific approach to "scientific texts" is not only posited as description, but is raised into a norm, a law. Scientific texts should conform to this standard; Mrs. Gopnik takes it for granted that "the style of the text will be free from any . . . transformations which could in any way obscure the content of the texts" (pp. 11-12).

This is not the place to inquire into the personality that accepts, or the mood of a society that adopts such a law, with its espousal of seemingly monotonous and sterile writing. But it is necessary to question the air of impartiality, literalness, factuality, and material purity with which Mrs. Gopnik seems to endow her texts: "It is certainly easier to determine the meaning of a technical word like cyclophosphoramide than of a non-technical word like justice. Since technical terms have this well defined range of meanings . . . the problems of reference and the choice between possible ambiguous transformational routes is somewhat reduced" (p. 12).
We find in fact that, while stressing cold content and narrowing down to the simplest value of individual words, Mrs. Gopnik is concerned with more than information and description. She acknowledges this. She presupposes "a coherent text," and grants that "not every sequence of sentences," even though scientifically accurate, produces such a thing (p. 9). She suggests that "syntactic and semantic" criteria (p. 13) are necessary to establish "texthood." But will these in fact suffice? Mrs. Gopnik continually uses "reoccurrence" as a gauge of coherence, without inquiring into the structural and tonal effects of that device, or touching on the issue of conceptual fit where numerous and complex elements must come together (cohere) in one presentation. In short, one must wonder whether "scientific texts," even those that are "as free as possible from stylistic variation" and "outside references," do not carry within themselves an interpretive scheme, a preferential principle of ordering and construing material, as well as an attitude and an intention vis-à-vis both materials and audience?

Is it in fact possible for the text, as text, to partake of the formal insularity and the technical purity of the instruments and the process whereby its subject matter is produced? The ideal, or rather the idea of a text clinically pure, infallibly clear, and irresistibly sure goes back to that milestone in the development of modern science, the founding of the Royal Society of London for Improving Natural Knowledge, in Restoration England. Bishop Thomas Sprat, in his contemporary History of the Royal Society, speaks of "primitive purity and shortness," and imagines men who "deliver'd so many things almost in an equal number of words," with a premium on "positive expressions, clear senses ... bringing all things as near the Mathematical plainness" as possible.2

This stylistic norm, canonizing simplicity, clarity, accuracy, concreteness, and objectivity, rested on a presumption that not only research but the researcher could be antiseptic and neutral. The object, as Thomas Sprat put it in his History, was "to attain a solid speculation ... by a long forbearing of speculation at first, till the matter be ripe for it; and not by madly rushing upon it in the very beginning."3 But Werner Heisenberg, an eminent modern physicist and theorist of science, leaves no doubt that the choice of an experiment, to say nothing of the chooser, affects what we call its reality. Perfect neutrality and objectivity are not to be had. Indeed, Heisenberg's chapter on "Language and Reality in Modern Physics," in Physics and Philosophy, makes it clear that not even agreement
is to be had among scientists. Real convictions and passions, conceivably even assumptions and prejudices, bear on scientific findings, and on scientists' responses thereto. Perhaps Heisenberg unwittingly harbors the old simon-pure ideal of scientific writing; he contends that the problem will pass, that "one has not yet found the correct language with which to speak about the new situation." As he goes on to remark that the "improved experimental technique of our time brings into the scope of science new aspects of nature," one is hard put to see when the "correct" language will materialize.4

But the elusiveness of an ultimately and utterly correct language reflects more than the changing dimensions and conditions of scientific inquiry. It reflects at bottom the condition of language itself. The process of research, rendered in language, takes on not only a different form but also a new character. The process may dwell on what Bishop Sprat calls things, but the adoption of words goes beyond that mere matching and numerical correspondence which Sprat conjures up. As the eminent theorist and philosopher of language, Jacques Derrida, has remarked, "there is no linguistic neutrality." And it is a scientist who points out the aptness of that contention for scientific writing. In Chance and Necessity, Jacques Monod, a Nobel laureate in physiology, plainly speaks of the biologist's "efforts to 'understand' the entire functioning of the human brain," indeed of the human being.5

Mrs. Gopnik's study, after a lapse of more than two centuries, seeks to institutionalize and codify the values that Bishop Sprat and the Royal Society espoused. But, in spite of Heisenberg's stubborn dream of a "correct language," both science and linguistic philosophy bring the project under serious suspicion. The Sprat-Gopnik formula is, for all its unassuming neutrality of surface, vigorously leading and even dogmatic in relation to its audience. It is no less personal and bound to the world of style than the literary modes it sets itself against. Like a plain gray dress at a fashionable soirée, it expresses a commitment and a mission, and is no less passionate and purposive and problematical than Euphuism, or legalese. In a way scientific writing may depend as much on the "writing" as on the "science" for its effect.

Let us take a few famous examples of scientific writing, and see how far they reconcile the dual interests of science as objective knowledge and of science as human understanding. In the process, there should arise a fair opportunity to say something about science and its hold on modern culture, and about writing, as an arcane
symbolic activity, and its relation to the supposed objectivity and standardization of science.

It will benefit us, in this analysis, to keep in mind that one of the earliest ideas of systematic scientific inquiry, as Lucretius records, was to deliver mankind from superstition and darkness of mind. (A synonym for "superstition" might be religion, for "darkness of mind" symbolism.) In any case, science begins in ancient times with a program; it takes a stand in relation to social and intellectual authority. In his *Novum Organum*, Sir Francis Bacon, at the threshold of the modern scheme, makes the program explicit: "Scientia et potentia in idem coincidunt," which reads in English, "Knowledge (Science) and power boil down to the same thing" (italics added).

We have to be cautious around the shrine of disinterested factuality reared by science. The problem goes beyond the fact that science always has a tacit program. It compounds itself by virtue of the fact, cogently articulated by Heidegger, that the total system of human discovery, of which science is but a part, always occurs *in a context*, and cannot attain to either absoluteness or absolution from what Mrs. Gopnik calls "outside reference." As Croce says, "there are no immobile facts, nor can such things be envisaged in the world of reality. Historical judgment is embodied even in the merest perception of the judging mind." Or again we can listen to John Steinbeck and Edward F. Ricketts: "the impulse which drives a man to poetry will send another man into the tide pools and force him to try to report what he finds there."

If we turn first to Darwin to represent scientific style, we can see at once how involved a matter it can be to set forth the so-called facts of nature. We will never know how long Darwin might have brooded over his *Origin of Species* if A. R. Wallace had not independently worked out a comparable formulation based on analogous data. He waited, we do know, from 1844 to 1858 to come out with his findings, and why? Because they were as much power as fact, as much an ordination of meaning as an organization of details. And the meaning would be scandalous to his society, to his world; as the wife of the Bishop of Worcester would say: "Descended from apes! My dear, let us hope it is not so; but if it is, let us hope it does not become generally known."

How does Darwin write, how does he meet the total situation, the complex state and quality of his material? How does he meet *our* minds and construct *our* positions through his writing? Is he
not working to take in the reader with all the disarming diminuendos of his “Introduction,” in statements such as “these facts . . . seemed to throw some light on the origin of species” (italics added)? Is he not guarding against doubt with the most cautious, circumspect, and indeed nun-like crescendo ever produced to announce an epochal discovery and concept? Darwin carefully shows that he takes half a decade to allow himself to “speculate on the subject,” another brace of years to do “a sketch of the conclusions” that “seemed . . . probable,” and then a decade and a half of assiduous labor before allowing himself to be persuaded by eminent scientists to publish “some brief extracts” which even so “must necessarily be imperfect.”

Nor is the body of the text free from rhetorical manipulation. Let us look closely at the opening sentences of *The Origin of Species*:

> When we compare the individuals of the same variety or sub-variety of older cultivated plants and animals, one of the first points which strikes us is, that they generally differ more from each other than do individuals of any one species or variety in a state of nature. And if we reflect on the vast diversity of the plants and animals which have been cultivated, and which have varied during all ages under the most different climates and treatment, we are driven to conclude that this great variability is due to our domestic productions having been raised under conditions of life not so uniform as, and somewhat different from, those to which the parent species had been exposed under nature. (p. 104)

For myself it is necessary to confess that, even with Darwin’s expert help, the degree of difference between cultivated and wild plants is not one of the first points to strike me, nor is the comparison the first to come to my mind. But I am either implicated in Darwin’s conclusion, or cowed by the implied multitude of authorities in agreement that his simple pronoun, “we,” inevitably arrays before me. In either case, resistance and shock dwindle. An authority at once soothing and coercive is established, and is secured by the careful detail and careful complexity of rhythm and thought (“raised under conditions of life not so uniform as, and somewhat different from”). This authority of the “we” seems virtually comprehensive. The reader is co-opted and quieted. The worst thing to be said of Darwin’s various opponents remains to be said, namely, that they had no sense of style.
What, though, of the "I" presented in the "Introduction"? The scrupulous, apologetic "I", so slow to take any position, so fearful of offending? It is important to recognize the authority of that "I", an authority working as a complement to that of the "we". Indeed, it works as its obverse, the way an olive branch is the best obverse of the coin that boasts the imperious Caesar.

These two authorities or controlling postures continue throughout The Origin of Species. It will be of value to look at one illustrative passage where Darwin is going full cry, and where, incidentally, the claims of the opening sentences as to the differences in variety arising between domestication and the wild state seem to be contradicted. He is talking about the almost limitless variety possible in time and in the state of nature, and seeking to fit this to the principle of "the survival of the fittest," seeking to introduce an interest if not a teleology into the seemingly random plethora of nature.

Mere chance, as we may call it, might cause one variety to differ in some character from its parents, and the offspring of this variety again to differ from its parent in the very same character and in a greater degree; but this alone would never account for so habitual and large a degree of difference as that between the species of the same genus. As has always been my practice, I have sought light on this head from our domestic productions. We shall find here something analogous. (p. 137)

By now the "I" is a bit firmer in its ethos, counting on our trust in its regularity and diligence for the "light"; and the "we" can correspondingly be seen enlarging its range as it moves from common observation ("one of the first points which strikes us") to singular prophecy ("we shall find").

Having indicated how "two well-established and distinct breeds" of horses can develop over centuries from "one nation or district" requiring swifter animals whilst "another required strong or bulkier" ones, Darwin takes up the underlying issue of a non-human, as it were spontaneous influence on species.

How, it may be asked, can any analogous principle apply in nature? I believe it can and does apply most efficiently (though it was a long time before I saw how), from the simple circumstance that the more diversified the descendants from any one species become in structure, constitution, and habits, by so much will they be better enabled to seize on many and
widely diversified places in the polity of nature, and so be enabled to increase in numbers. We can clearly discern this in the case of animals with simple habits. (p. 139)

This passage brings out the basic purpose of the insinuations of Darwin's "I" and "we", namely, to gain an advantage in an argumentative situation. He uses analogy continually in The Origin of Species. Here he confronts the question of its legitimacy and efficacy, and answers with a Q.E.D., as domestic animals shed light on "carnivorous quadrupeds," and what holds true for them holds true also for plants (p. 138). But the analogies in the realm of the material are not independently or neutrally taken up. They reinforce a primary analogy in the relationship Darwin bears to his reader. His "I" is analogous to the cautious, even skeptical reader, who deplores humbug and scandal and who is convinced only because of overwhelming evidence, and his "we" is analogous to the proud, all-comprehending reader, who would never lag behind in matters of reason and truth. Not that Darwin plucked these personae out of the air, with sly rhetorical intent. They are genuine moods, stages, values in his autobiography and in ours.

The name of D'Arcy Thompson is not widely known, and may seem rashly paired with Darwin's. But Thompson's name, where it is known, is revered at a rate not far behind Darwin's. He was born the year after publication of The Origin of Species, that is in 1860, and died in 1948. Thompson grew up in two cultures, both nationally and intellectually; his father was English, his mother French, and he was an accomplished classicist as well as an original biologist. His book, On Growth and Form (1917), is still regarded as a classic of modern biology, and some of us regard it as a classic of English writing.

Thompson is an avowed materialist. He basically attempts to use mathematics "to describe and physics to explain, the fabric of the body" and so we should expect a thoroughly "scientific" text. That, I suggest, is what we get, not in terms of facts but of meanings, not according to finality (still a bugaboo of scientific thinking) but according to the maximum possible system of relationship. Thompson applies the principle of analogy that Darwin formulates and defends, and he does so with a dexterity, range and precision that any poet might envy. As he himself, the consummate materialist declares, "Physical science and philosophy stand side by side, and one upholds the other."10

What, then, is Thompson's philosophy? We know that he
thought natural selection an eliminative, not a creative force, and held to physical forces, molecular or mechanical, as the causes of adaptation. But that is not the only, or the first “philosophy” manifested in the writing. Here is a representative excerpt from his prose:

To turn one circle (or sphere) into two circles (or spheres) would be, from the point of view of the mathematician, an extraordinarily difficult transformation; but, physically speaking, its achievement may be extremely simple. The little round gourd grows naturally, by its symmetrical forces of expansive growth, into a big, round, or somewhat oval pumpkin or melon. But the Moorish husbandman ties a rag around its middle, and the same forces of growth, unaltered save for the presence of this trammel, now expand the globular structure into two superposed and connected globes . . . . It is clear, I think, that we may account for many ordinary biological processes of development or transformation of form by the existence of trammels or lines of constraint . . . . This case has a close parallel in the operations of the glass-blower . . . . (pp. 286-87)

We note at once that Thompson, like Darwin, introduces himself (“I think”) and has recourse to the first person plural pronoun (“we may account . . . ”). But in On Growth and Form these are incidental touches, sequins, rather than part of the fabric of the thought. At the same time it is clear that Thompson draws in many more personal elements and considerations than Darwin. His person, the singular human presence, is less in evidence, but his personality, the extent and character of his interests, much more urgent. This difference perhaps reflects the fact that Thompson has no specific, localized, distinguishable, concrete subject, such as Darwin’s species and natural selection. His topic is abstract, all-comprehending, and everything is reduced to an illustration of the concept of growth and form. Thus Thompson looks at once more conceptual and more imagistic than Darwin.

In a sense, Thompson can never prove, or theorize, like Darwin, but only point. It is the richness and facility of his pointing that give him authority. If he can never be final or exhaustive, he can nevertheless be satisfying and even stunning to the reader. In the brief passage on transformation before us, we encounter “marbled paper” in a spacious paragraph, then pivot to the question of how, mathematically, one circle may be turned into two, which instantly
produces the Moorish husbandman making two gourds out of one and as many forms of standard gourds as he exerts himself to do (we look back and know that the mathematician is worsted here too). Thompson then briefly generalizes about the relation of "trammels or lines of constraint" to "uniform and symmetrical" patterns of growth and is led thus to glass-blowing, and thence, with a bow to Oliver Wendell Holmes, to the alimentary canal, and then to the difference between glass that is blown and glass that is mechanically made.

It is a wide and weird assortment, and bears directly as such on what Thompson is doing to the reader. Thompson's is a style of insistent variety, no doubt necessitated by the abstraction and all-inclusiveness of his topic, but also, it must seem, assumed to apply a personal, rhetorical force to the growth and form of the reader's mind on his subject.

We can hear our subjection and Thompson's insistence in the details and in the rhythm of one climactic section:

Nature does just what the glass-blower does, and, we might even say, no more than he. For she can expand the tube here and narrow it there; thicken its walls or thin them; blow off a lateral off-shoot or caecal diverticulum; bend the tube, or twist and coil it; and infold or crimp its walls as, so to speak, she pleases. Such a form as that of the human stomach is easily explained when it is regarded from this point of view; it is simply an ill-blown bubble, a bubble that has been rendered lopsided by a trammel or restraint along one side, such as to prevent its symmetrical expansion—such a trammel as is produced if the glass-blower lets one side of his bubble get cold, and such as is actually present in the stomach itself in the form of a muscular band.  

Our only consolation has to be our perception of Thompson's devotion to the idea of matter, of forces molecular or mechanical. That is human, as is the Moorish husbandman who affords a sense of hierarchy if not exemption in Thompson's scheme of growth and form.

At this point I am left with the temptation to ask: What force caused Thompson to write? Is writing encompassed in his idea of matter, the digestion and incorporation of ideas as well as food? And as to Darwin, why did he see fit to write, when he feared to perish if he published? When we think of all our reasons for not writing, whether it be grocery lists, love letters, applications,
treatises, autobiographies, cultural history, theology . . . , the productions of Darwin and Thompson in relation to the implied obstacles take on great significance.

It seems fair to say that anyone who writes is looking not just to be an author but an authority. We live in an age that betrays two extremes of emphasis, on the internal constitution of humankind and on the external constitution of matter. Both extremes have generated an enormous literature, almost in spite of themselves. The overemphasis on the internal should result in solipsism, but it results in Freud and Jung and Adler, and so on exponentially by the generation. The overemphasis on the external should lead to ant­like mechanism, but instead it leads to Heisenberg, Crick, Sagan, Luria, Thomas, and so on. Each has its authors, its need for authority. And scientific writers no less than poets, are moved by a magical sense of control, by the possibilities of revelation, definition, and orientation (or instrumental efficacy) in the world. They too write to confirm and preserve experience, to satisfy an intrinsic as well as a social impulse; and are as subject to frustration of that social impulse as any poet.

And yet there is a favoritism toward science in our culture. Mankind perennially loves a story, and in today’s society evinces a singular longing for facts. And science, in unrivalled measure, has in its hands the opportunity to satisfy the appetite for facts along with the need for stories; biologists and physicists, rather than theologians and philosophers, are telling the story of the origin of the universe, its history, its spawning of man, its symmetries and crises and serendipities.

It is odd, by which I mean ungenerous and a touch suicidal, for science to be setting a standard of monotony and sterility as its distinctive style. This is a false and, for all but the most relentless mediocrity, impossible style. More, it is a dangerous one. For it denies time, which is the medium of science despite its fondness for repetition, and which is the medium of man, the medium in which we learn what we inherit and what we suffer (Thompson’s forces), in which we recognize the patterns and principles (Darwin’s processes) which apply constantly to us and to which we may as constantly apply ourselves.

I think of Darwin in the Galapagos, and realize how critical that experience was for modern culture. But when I think of Darwin writing, I am convinced that I have come closer to the essential act or condition of his impact and influence. Not the mere writing, but
the impulse to write, the ground of continuity between ancient symbolism and modern science. Darwin writing is akin, for me, to Orpheus singing in spite of death, the Swan singing because of death, and Scheherazade singing to ward death off. Scientific writing occurs to turn facts, which Coleridge called, "as facts, essentially fixed and dead," into the art of knowledge and power, scientia et potentia.

NOTES


3Sprat, History, p. 107.


11Thompson, On Growth, p. 287.