

The Scientist as Poet

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“All is flux,” insisted the philosopher Heraclitus, and never was this truer than today. The alacrity with which the modern world revolutionizes itself often bewilders even those resilient souls who have lived all their lives in a culture which “changes shapes with Proteus for advantage.”

Swept up in the midst of change, our society is continually threatened by unprecedented demands, many of which can only be met by a strong and adaptable science. Innovation becomes synonymous with survival in such matters as, e.g., acquiring controlled thermonuclear power sources, extracting minerals and clean water from the sea, distributing and absorbing mountains of information, maintaining superior defense capability, and stemming the advance of hunger.

Today a strong culture depends on a strong science; and strong science turns senile without innovation. But innovation is a matter of *perceiving* what others have never seen before, though it be under their noses. It is not a matter of disciplined reasoning, and it is not taught as a course in the universities.

Among those uncommon individuals who retain far into maturity a childlike freshness of vision, we have long been familiar with the poet and the idiot. To this company I think we may properly add the *creative* scientist.

The poet and the scientist are both, in essence, striving to really see the world, not only in its culturally and verbally imposed aspects, but in its immediacy and its inexhaustible wonderment. The poet is mainly concerned with the impact of the world on the spirit, and he spends his time trying to lure subtle feelings out into the open and express them clearly, in a way that will bring them forth again. The scientist, much the same, is trying to ferret out and clearly express relations between the superficially disconnected aspects of the world. Like the poet, he is only satisfied with

a coherent, esthetically simple description of our experience. Both are attempting new and unheard of exploits in perception, both are exploring that *terra incognita* of mind where *anything* may be discovered by the man who can open his eyes wide enough to see it.

It is clear that this business of having wide-open eyes is no mean trick. It is the sine qua non of innovation, the ‘open sesame’ of creative breakthrough in science as in anything else. . . but most spectacularly in science, where logical machinery of unmatched power and precision lies in readiness to develop each insight to the fullest. That this business is the chief accomplishment of the poet and his most highly developed skill is compelling motivation for the scientist to appreciate his mode of perception. Observance of the ethic of “open-mindedness” is only a beginning, for without “a touch of the poet” we have nothing but technicians.

What do *you* see when you look at the moon in the sky? Everyone before him saw just what everyone else saw—the moon—but Newton saw Universal Gravitation. Newton’s imagination was not deterred by the accepted “impossibility” of force-at-a-distance. And how did Kekulé, the father of structural organic chemistry, penetrate the enigma of carbon’s versatility? Not only by long laboratory hours; his inspiration was the immediate effect of dreaming by the fireside, of letting his mind wander in fanciful paths of free association. Was Planck’s revolutionary creation of “h” an inevitable consequence of classical concepts? Certainly not. His was a triumph of imaginative freedom, and it was only by his fantasy of the most unconventional models that he introduced something new into our understanding of Nature.

These are not instances of logical deduction any more than the insights of the great mathematicians were first obtained as inescapable con-

sequences of the existence of zero and one. Even disregarding the very important psychological reasons for this superficially *ex nihilo* feature of the creative act, its inevitability can be read from the very structure of reason itself. Well though not widely known is the result of Kurt Gödel's analysis of the two thousand year old axiomatic method: that our understanding of the world will *never* be put on a rigorously deductive basis simply because this would require innumerable axioms. Where, then, are we to get the new principles needed to expand our appreciation of Reality? We get them by induction, imagination, and poetic insight.

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Insofar as the poet has method in his madness and insofar as the scientist is innovator, their modes of perception share a few distinctive features that cannot fail to be fruitful if consciously emphasized.

Examining the commonplace from a strange viewpoint is a valuable eye-opener whether practiced by the poet who stands on his head better to see the beauty of a sunset, or by the scientist trying to visualize a crystal lattice from the electron's point of view. The object in either case is to divest a phenomenon of its obscuring incrustation of familiarity.

But more effective in the poet's arsenal is his dexterity with metaphor. It is almost a cliché today that language is dead and stiffened poetry—a mosaic of forgotten metaphors. And in this it is an accurate reflection of the mind's organization when searching for meaning. Each concept and each percept is an association of partly related memories all evoked together by the saying of a word. To the poetic undertone of intelligence the sea is not only salt spray: its resonances excite time, power, the sandcastles and sunshine of childhood, eternity, the unknown, and vacation cruises.

The poet makes good use of his language, less to convey precise information than to guide the thoughts and feelings in search of new syntheses of meaning. It is from such uninhibited explorations of the poetic resonances of our concepts that the most valuable and surprising innovations are often retrieved.

For the scientist this observation has a special and exciting significance not accessible to others,

for the scientist is not confined to the languages of tradition alone. In mathematics we find a tool of a more modern cast, a language capable of handling concepts and similarities utterly untouchable in English. When a scientist conceives of a new relation between ideas, he has only planted the seed of a greater idea that will blossom completely in the "language of science." For a spectacular example of such flowering, just recall the explosive ramification of Schoedinger's simple concept of the Ψ -wave:

$$\nabla^2 + E \propto \frac{\partial}{\partial t}.$$

Mathematics is not only a powerful precision instrument, however. As a language, it shares the metaphoric potential of other languages, but is capable of greater abstraction in its "poetic resonances." Writing $e^{-\alpha t}$, that scientist resembles the poet, who is simultaneously reminded of thermal relaxation, his bank account, a ringing bell, atmospheric pressure, the world population, and a snail shell. But the man who is intimate with the language of group theory, dimensional analysis, or the theory of rings has left the poet far behind. If English is fertile of meaning when playfully exploited, consider the depth of significance accessible to the poet-scientist who listens for resonances in Hausdorff-space!

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While such fruitful combination of poetic and scientific outlooks in a single individual was fortuitous in the past, today it urgently needs to be cultivated. Failure to see what does not conform to the culturally imposed *Weltanschauung*, what is not explained by the currently popular model, can only be called tragic in a time when time-honored disciplines are dissolving and science is ripe for reconstruction. But in the midst of such flux the excitement of innovation should be no stranger to the explorer who makes it a habit:

"To see the world in a grain of sand, and
a heaven in a wild flower."

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