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Man and the Sea Shell

Preface

SINCE *the strangely delicate drawings, woven rather than traced by the fine and sensitive point of Henri Mondor's pencil, have provided an occasion to reprint this little work, I should like to say a few words more on the subject, as though, having taken leave of a friend, I should go back to add a detail or two to our conversation.*

It was chance that made me write about sea shells, very much as though bidding me, by the seashore, to take notice of one of these delightful objects. In taking this marvel as my theme, I did the same as a passer-by who has just picked up a small, curiously formed, calcareous shell in the sand; who examines it and handles it, admiring its mineral convolutions and the arrangement of spots, streaks, spines suggesting the past movement in which they were engendered. I meditated my unexpected theme and raised it closer to the eyes of my mind; I turned it over and over in my thoughts. . . . I knew next to nothing about mollusks, and I took pleasure in illumining, one by one, the facets of my ignorance.

Ignorance is a treasure of infinite price that most men squander, when they should cherish its least fragments; some ruin it by educating themselves, others, unable so much as to conceive of making use of it, let it waste away. Quite on the contrary, we should search for it assiduously in what we think we know best. Leaf through a

dictionary or try to make one, and you will find that every word covers and masks a well so bottomless that the questions you toss into it arouse no more than an echo.

In the matter of shells, then, I did my best to define my ignorance, to organize it, and above all to preserve it.

Among the many objects that confront man's mind with questions, some more legitimate than others, he is particularly fascinated by those which, by their form or properties, lead him to reflect on his own powers or tendencies. He is amazed to find objects which, though it is inconceivable to him that they should have been made, *he can compare to those he is able to make. In such objects he seems to recognize his own familiar modes of thought, his own types of conscious action: his incorrigible "causality" and "finality"; his geometry; his ingenuity; his need for order and his bursts of inventiveness. As soon as he glimpses an adaptation, a regular functioning, definable forms, an order, in a product of "nature," he cannot help trying to "understand"; that is, the object becomes a* problem *for him and he begins to consider it as the effect or result of some sort of* making, *which remains to be defined.*

Complete human action, with its own possibility *and* necessity, *its means, its material, its aim, is the inevitable and unique type on which every "explanation" is modeled. What we know of ourselves, our acts, our impulses, of what satisfies our instincts and fits in with our structure, in other words the "forces," the "time," the "space" that suit us, these are the instruments by which we reduce all things to our measure. When we are perplexed, that is, when we have carried our familiar questionnaire too far, an appropriately vague language comes to our aid, masks our helplessness, and enables us (what an admirable thing) to go on arguing indefinitely.*

We talk about creation, evolution, chance, *and we endow these terms with precisely everything required in the way of power, disorder, time, and large numbers, to stimulate our minds and, by an odd contradiction, to satisfy them. It is a great mystery to me how opinions on subjects of this kind can differ as much as we know they do.*

But I see that I am gradually slipping from one problem to another, from the formation of shells to the formation of hypotheses, which is perhaps less disheartening to meditate upon. Our intellect is not so rich as it supposes in tenable hypotheses. A man is always at a loss when experience shows him that one phenomenon must be connected with another which seemed unrelated to it. He must own that the connection would never have occurred to him.

Yet mysterious as the genesis of shells may be to the metaphysical eye, an artist, at all events, can examine them as long as he pleases without wasting his time.

Run off by the billions, each different from the rest (though the difference is sometimes imperceptible), they offer an infinite number of solutions to the most delicate problems of art, and of absolutely perfect answers to the questions they suggest to us.

I have indicated in the text of my essay that it was child's play for what we call "living nature" to obtain the relation between form and matter that we take so much pains to attempt or to make some show of achieving. Our hands busy themselves in various acts, all distinct and determinate; with our eyes and our intention we order and supervise this superficial maneuver; but our activity is composite and must always be so; and thus we can never, in our object, arrive at the happy union of substance and shape that is achieved by the inarticulate creature which makes nothing, *but whose work,*

little by little, is differentiated from its flesh, progressively moving away from the living state as though passing from one state of balance to another.

In this invincible and one might say flawless progression of form, which involves and develops its whole setting according to the continuous fatality of its convolutions and seems to create its own time, we admire the combination of rhythm, *marked by the regular spots or spines, and of* indivisible movement. *It is like seeing music. The correspondence of ornaments on successive spirals suggests a counterpoint, while the continuity sustains the main theme of the rotation of the surface.*

But suddenly an end must come. This strange torsion must cease, the nacre on the inside and the coarser covering must join, and the distinction between the two substances of the shell must vanish or explain itself, while at the same time its form must be completed by some decision that remains to be arrived at.

The problem is very general in kind. Living nature must solve it in all the types it displays, all of which involve extremities to be modeled and cavities or tubes that must be made to reach the outside world. The mind staggers at the mere thought of analyzing the innumerable solutions it has found. We yearn for a profound geometry, a very exact knowledge of what is revealed by dissection and microscopic examination, and an exquisite artistic feeling which, taken together, might enable us to isolate some simple basic principle of natural morphology.

This is a mystery that has always teased my mind, for I can find nothing in the arts that captivates me more than forms or phases of transition, *the refinements of* modulation. *For me, perfect modulation is the crown of art. But in our time little importance is attached*

to this ideal of mine. The architect knows only his rule and square. The musician does pretty much as he pleases. The poet proceeds by leaps and bounds. But nature has preserved her cautious methods, the inflection in which she envelops her changes of pace, direction, or physiological function. She knows how to finish a plant, how to open nostrils, a mouth, a vulva, how to create a setting for an eyeball; she thinks suddenly of the sea shell when she has to unfold the pavilion of an ear, which she seems to fashion the more intricately as the species is more alert.

IF THERE were a poetry of the marvels and emotions of the intellect (something I have dreamed of all my life), it could find no subject more delightful and stimulating than the portrayal of a mind responding to the appeal of one of those remarkable natural formations which we observe (or rather which make us observe them) here and there, among the innumerable things of indifferent and accidental form that surround us.

Like a pure sound or a melodic system of pure sounds in the midst of noises, so a *crystal*, a *flower*, a *sea shell* stand out from the common disorder of perceptible things. For us they are privileged objects, more intelligible to the view, although more mysterious upon reflection, than all those which we see indiscriminately. They present us with a strange union of ideas: order and fantasy, invention and necessity, law and exception. In their appearance we find a kind of *intention* and *action* that seem to have fashioned them rather as man might have done, but at the same time we find evidence of methods forbidden and inaccessible to us. We can imitate these singular forms; our hands can cut a prism, fashion an imitation flower, turn or model a shell; we are even able to express their characteristics of symmetry in a formula, or represent them

quite accurately in a geometric construction. Up to this point we can share with "nature": we can endow her with designs, a sort of mathematics, a certain taste and imagination that are not infinitely different from ours; but then, after we have endowed her with all the human qualities she needs to make herself understood by human beings, she displays all the inhuman qualities needed to disconcert us. . . . We can conceive of the *structure* of these objects, and this is what interests us and holds our attention; but we do not understand their gradual *formation*, and that is what intrigues us. Although we ourselves were formed by imperceptible growth, we do not know how to create anything in that way.

The shell which I hold and turn between my fingers, and which offers me a combined development of the simple themes of the helix and the spiral, involves me in a degree of astonishment and concentration that leads where it may: to superficial remarks and observations, naïve questions, "poetic" comparisons, beginnings of reckless "theories." . . . And my mind vaguely anticipates the entire innate treasure of responses that rise within me in the presence of a thing that arrests and questions me. . . .

First I try to describe this thing to my own satisfaction. It suggests to me the movement we make when we roll a sheet of paper into a cone. One edge of the paper forms an inclined plane that rises toward the tip and ends after a few turns. The mineral cone, however, is formed by a tube and not by a flat sheet. With a tube closed at one end and assumed to be flexible, I not only can reproduce quite well the essential form of a shell, but can also fashion a number of others, some of which, like this one I am examining, might be inscribed in a

cone; while the others, obtained by reducing the *pitch* of the conic helix, will end by coiling like the spring of a watch.

Thus the idea of a *tube* and the concept of *torsion* suffice for a first approximation of the form under consideration.

But this simplicity applies only in principle. If I examine a whole collection of shells, I find a marvelous variety. The cone lengthens or flattens, narrows or broadens; the spirals become more pronounced or merge with one another; the surface is incrusted with knobs or spines, sometimes strikingly long, radiating from a center; or it may swell, puffing out into bulbs separated by strangulations or concave gorges where the curved lines meet. Engraved in hard matter, furrows, wrinkles, or ribs follow and accentuate one another, while, aligned on the generatrix, the protuberances, the spines, the little bumps rise in tiers, corresponding from row to row and breaking up the regular intervals of the planes. The alternation of these "ornaments" illustrates, more than it interrupts, the continuity of the general *convolution* of the form. It enriches but does not modify the basic motif of the helical spiral.

Without modifying it, without ceasing to follow and confirm its own unique law, this *idea* of periodic progression exploits all the abstract fecundity of the helix and develops its full capacity for sensuous charm. It beguiles the eye, drawing it into a kind of controlled vertigo. A mathematician, no doubt, would easily read this system of "skew" lines and surfaces and would sum it up in a few signs, a numerical relation, for it is in the nature of the intelligence to do away with the infinite and to abolish repetition. But common language is ill suited to describing forms, and I despair of expressing their

whirling grace. Actually, even the mathematician is baffled when in the end the tube suddenly broadens, breaks, curls back, and overflows into uneven lips, often bordered, waved, or fluted, which part as though made of flesh, disclosing in a fold of the softest mother-of-pearl the smoothly inclined starting point of an internal whorl that recedes into darkness.

Helices, spirals, spatial developments of angular relations—the observer who considers them and endeavors to translate them into his own modes of expression and understanding, cannot fail to perceive one essential characteristic of forms of this type. Like a hand, like an ear, one shell cannot be mistaken for another that is its symmetrical counterpart. If we draw two spirals, one the mirror image of the other, no manner of moving these twin curves will enable us to superimpose one on the other. It is the same with two stairways, similar but turning in opposite directions. All shells whose form derives from the rolling of a tube necessarily manifest this *dissymmetry*, to which Pasteur attached so profound an importance, and from which he derived the main idea for the investigations that led him from the study of certain crystals to that of ferments and their living agents.

But despite the dissymmetry of all shells we might, among a thousand specimens, expect the number of those whose spirals turn "clockwise" to be approximately equal to those turning in the opposite direction. This is not the case. Just as there are few left-handed men, there are few shells which viewed from the tip disclose a spiral receding from right to left. Here we have another, quite remarkable sort of statistical dissymmetry. To say that this difference in bias is *accidental* is only to say that it exists. . . .

Thus the mathematician I mentioned a moment ago has been able to make three simple observations in his study of shells.

He first noted that he could describe their general form with the help of very simple notions drawn from his arsenal of definitions and operations. Next, he saw that quite sudden —one might say unforeseen—changes occurred in the forms he was contemplating: the curves and surfaces that made it possible to represent their construction suddenly broke off or degenerated: whereas the cone, the helix, the spiral can well go on "indefinitely," the shell suddenly wearies of following them. *But why not one turn more?*

Lastly, he finds that the statistics of right-handed and left-handed shells marks a strong preference for the former.

We have given a superficial and very general description of a shell chosen at random; and now, if we have time and the inclination to follow the development of our immediate impressions, we might ask ourselves a very naïve question, one of those questions that arise in us before we remember that we are not newborn, but already know something. First of all, we must allow for this; and remember that our knowledge consists largely in "thinking that we know" and in thinking that others know.

We are always refusing to listen to the simple soul within us. We ignore the inner child who always wants to see things for the first time. If he questions, we discourage his curiosity, calling it childish because it is boundless, on the pretext that we have been to school and learned that there is a science of all things, which we might consult if we wished, and that it would be a waste of time to think in our own way and no other about an object that suddenly arrests us and calls for an answer. Perhaps we are too well aware that an enormous stock

of facts and theories has been amassed, and that in thumbing through the encyclopedias we may find hundreds of names and words that represent this potential wealth; and we are too sure that we can always find someone somewhere who, if only to impress us, will be glad to enlighten us on any subject whatsoever. And we promptly withdraw our attention from most of the things that begin to arouse it, thinking of the learned men who must have explored or disposed of the event that has just stirred our intelligence. But such caution is sometimes laziness; and moreover, there is no proof that everything has really been examined, and in all its aspects.

So I shall ask my very naïve question. I can easily imagine that I know nothing about shells except what I see on picking this one up; and that I know nothing about this shell's origin, its function, its relations with what I am not considering at this particular moment. I am following the example of the man who one day made *tabula rasa*.

I look *for the first time* at this thing I have found. I note what I have said about its form, and I am perplexed. Then I ask myself the question: *Who made this?*

Who made this? asks the naïve moment.

My first stir of thought has been to think of *making*.

The idea of *making* is the first and most human of ideas. "To explain" is never anything more than to describe a way of *making*: it is merely to remake in thought. The *why* and the *how*, which are only ways of expressing the implications of this idea, inject themselves into every statement, demanding satisfaction at all costs. Metaphysics and science are merely an *unlimited* development of this demand. They may even lead us to pretend not to know what we know, when what we know refuses to be reduced to a clear knowledge of how to make something. . . . This is what we mean by going back to the beginnings of knowledge.

Here then I will introduce the artifice of a doubt: considering this shell, in whose shape I think I can discern a certain "construction" and as it were the work of some hand not acting "at random," I ask myself: *Who made it?*

But soon my question undergoes a transformation. It takes a short step forward along the path of my naïveté, and I begin to inquire by what sign we recognize that a given object is or is not *made by a man?*

It may seem somewhat absurd to pretend not to know that a wheel, a vase, a piece of cloth, or a table has been produced by someone's industry, since we know perfectly well that it has. But what I say is that we do not know this *just by examining these things.* If no one had ever told us, then by what marks, by what signs should we know? What is it that indicates the presence or absence of a human operation? When an anthropologist finds a piece of flint, does he not often hesitate as to whether man or chance fashioned it?

The problem after all is no more futile nor any more naïve than speculation about *who made* a certain fine work in music or poetry; whether it was born of the Muse, or sent by Fortune, or whether it was the fruit of long labor. To say that someone composed it, that his name was Mozart or Virgil, is not to say much; a statement of this sort is lifeless, for the creative spirit in us bears no name; such a remark merely eliminates from our concern all men *but one*, within whose inner mystery the enigma lies hidden, intact. . . .

On the contrary I look at the object and nothing else: nothing could be more deliberately planned, or speak more harmoniously to our feeling for plastic shapes, to the instinct that makes us model with our fingers something we should delight to touch, than this calcareous jewel I am caressing,

whose origin and purpose I wish for a time to disregard.

As we say a "sonnet," an "ode," a "sonata," or a "fugue," to designate well-defined forms, so we say a "conch," a "helmet," a "cameo," a "haliotis," a "porcelain"—all of them names of shells; and each one of these words suggests an action that aims to make something beautiful and succeeds.

What can prevent me from concluding that *someone* has made this curiously conceived, curiously turned and ornamented shell that troubles my imagination—and made it perhaps *for someone?*

I found this one in the sand. It attracted me because it was not a formless thing but one whose parts and aspects manifested an interrelation, a sequence and harmony as it were, that enabled me, after a single look, to conceive and foresee the aspects I had not yet examined. Its parts are joined by something more than the cohesion and solidity of matter. If I compare this thing to a stone, I find that the shell has an identity which the stone lacks. If I break them both, the fragments of the shell are not shells; but the fragments of the stone remain stones, just as the stone itself was once no doubt part of a still larger one. Yet even now certain fragments of the shell suggest the fragments that were joined to them; in a measure they engage my imagination and incite me to think further; they call for a *whole*. . . .

My observations thus far concur to make me think it would be *possible* to construct a shell; and that the process would be quite the same as that of making any of the objects I can produce with my hands by choosing some appropriate material, forming the design in my mind, and proceeding, part by part, to carry it out. The unity, the wholeness of the shell's form, force me to conclude that a directing idea presides over the execution; a pre-existing idea, quite separate

from the work itself, an idea that maintains itself, supervises and governs, while on the other hand and in *another area* it is put into execution by means of my energies successively applied. I divide myself in order to create.

Then someone made this object. But *of what*? And *why*?

However, if I now attempt to model or chisel out a similar object, I am first of all compelled to seek a suitable way of molding or cutting it; and it turns out that there are only too many possibilities. I am in a quandary. I can think of bronze, clay, stone: in respect to form, the final result of my operation will be independent of the material chosen. Of this material I demand only "sufficient," not strictly "necessary," conditions. According to the material employed, my acts will vary, no doubt; but different as they, and it, may be, I obtain in the end the same desired figure: I have several ways of passing from my idea to its effigy by way of the material.

In any case I am unable to imagine or define a *material* with such precision that the consideration of form will wholly determine my choice.

Moreover, just as I may hesitate in regard to the material, I may hesitate about the dimensions I shall give to my work. I see no necessary dependence between form and size; I can conceive of no form that might not be larger or smaller—it is *as though the idea of a certain figure called forth in my mind an endless number of similar figures.*

Thus I have been able to separate form from matter and both of these from size; and merely by thinking in some detail of my projected action, I have been able to see how it breaks down into stages. The least reflection, the slightest meditation on *how I should go about fashioning a shell*, tells me at once that

I should have to act in several different ways, in several different capacities as it were, for I am not able to carry on all at once the numerous operations required to form the desired object. I shall have to connect them as though intervening from outside; and indeed, it is by a judgment independent of my action that I shall recognize that my work is "finished," that the object is "made," since the object in itself is only one possible stage, among others, in a series of transformations that might continue beyond their goal—*indefinitely*.

In reality I do not *make* this object; I only substitute certain attributes for certain others, and a certain relation that interests me for a certain diversity of forces and properties that I can only consider and utilize one by one.

I feel, finally, that if I have undertaken to produce one particular form, it is because I could have chosen to create entirely different ones. This is an absolute condition: if one can only make a single thing and in a single way, it means that the thing almost makes itself; therefore, such an action is not truly human (since thought is not necessary to it), and *we do not understand it*. What we make in this way really makes *us* more than we make it. What are we, if not a momentary balance between a multitude of hidden actions that are not specifically human? Our life is a tissue of such local acts in which choice plays no part, and which in some incomprehensible way perform themselves. Man walks, breathes, remembers—but in all this he is in no way different from animals. He knows neither how he moves, nor how he remembers; and he has no need to know in order to move or remember, nor does he need to know *before* doing so. But if he builds a house or a ship, if he forges a tool or a weapon, a design must first act upon him and make him into a specialized instrument; an *idea* must co-ordinate what he desires, what he can do, what he knows, what he sees, what he touches and manipulates,

and must organize all this expressly toward a particular and exclusive action, starting from a state in which he was entirely open and free from all intention. Once he is called upon to act, his freedom diminishes, relinquishes its rights, and for a time he accepts a constraint that is the price he must pay if he wishes to impress upon a certain "reality" the configured desire that he carries in his mind.

To sum up: all specifically human production is effected in successive, distinct, limited, enumerable acts. But up to this point certain animals, the builders of hives or nests, are quite like us. Man's specific work becomes unique when the separate, independent acts involved require his deliberate thinking presence to provoke them and adjust their diversity to an aim. Man consciously sustains his mental image and his will. We know only too well how precarious and costly this "presence of mind" is; how quickly the effort wanes, how our attention disintegrates, and that what arouses, assembles, corrects, and revives the efforts of our separate functions is of a nature quite different from them; and this is why our *considered* projects, our *intentional* constructions or fabrications *seem very alien to our underlying organic activity.*

Thus I can make a shell rather like this one I have examined; and I can make it only by means of a composite, sustained action such as I have just described. I can choose the material and the moment; I can take my time, interrupt the work, and return to it; there is no hurry, for my life in no way depends on the outcome but participates only in a revocable, one might say incidental, way; and though my life may spend itself on an object so far removed from its needs, it can equally well refrain from doing so. My life is indispensable to my work, but my work is not indispensable to my life.

All in all, within the limits stated, *I have understood this*

object. I have *explained* it to myself by a system of acts that are eminently mine, and I have thereby exhausted my problem: any attempt to go farther would modify it essentially and would lead me to slip from an explanation of the shell into an explanation of myself.

Up to this point, consequently, I can imagine that this shell is a work of man.

Still, one element of a human work is lacking. I do not see the *utility* of this thing; it calls to mind no need which it satisfies. It has intrigued me; it delights my eyes and fingers; I stop to look at it as I would stop to listen to a melody; and unconsciously I consign it to oblivion, for we unthinkingly withhold the future from whatever is of no use to us. . . . And I find but one answer to the question that comes to my mind: *Why was this object made?* But what, I ask myself, is the use of the things that artists produce? What they make is of a strange kind: there is no vital need for it. *It does not result from any necessity*, which as a matter of fact would determine its whole character; *still less can it be attributed to "chance."*

So far I have purposely ignored the true origin of sea shells, and attempted in my reasoning—or raving—to stick as close as possible to this feigned ignorance.

In this I have been imitating the philosopher, who makes every effort to know *just as little* about the well-known origin of well-defined things as is known about the origin of the "world" and the beginnings of "life."

Doesn't philosophy after all consist in pretending not to know what one does know, and to know what one does not? It doubts existence, but speaks seriously of the "Universe." . . .

If I have dwelt at some length on the act of a man who might apply himself to making a sea shell, it is because in my

opinion one should never lose an opportunity to compare, in some detail, our way of making things with the work performed by what we call *nature*. Nature: that is to say, the genetrix, the *producer*. Whenever we run across something we do not know how to *make* but that appears to be *made*, we say that nature produced it. Yet there are certain special cases where we can compete with nature, and attain by our own methods what it accomplishes in its way. We are able to make heavy bodies swim or fly and to construct certain "organic" molecules. . . .

All the rest—everything that we can assign neither to thinking man nor to nature's power of generation—we attribute to "chance." The word is an excellent invention. It is very convenient to have a word which enables us to say that a *remarkable* thing (remarkable in itself or in its immediate effects) is brought about *in exactly the same way as something else* that is not remarkable. But to say that a thing is *remarkable* is to bring in a *man*—a person who is particularly sensitive to it, and it is this person who supplies everything that is remarkable about it. What difference does it make to me, if I have no lottery ticket, whether one number or another is picked out of the urn? I have not been "sensitized" to the event. For me there is no "chance" in the drawing, no contrast between the uniform way in which these numbers are drawn and the inequality of the consequences. Take away man and his expectation, and everything comes out the same, sea shell or stone; but chance *makes* nothing in this world, apart from making us take notice of it. . . .

But now it is time for me to stop pretending and come back to the area of certainty, to the surface of common experience.

A sea shell emanates from a mollusk. To *emanate* strikes

me as the only term close enough to the truth since its proper meaning is: to *exude*. A grotto emanates stalactites; a mollusk emanates its shell. As to the elementary process of this emanation scientists tell us many things that they have seen under the microscope. They add a number of other things which I think they have not seen: some are inconceivable, though that scarcely precludes discoursing about them; others would require observation over hundreds of millions of years, for that much time is needed to change anything into anything. Others insist that some extremely favorable accident occurred at one point or another. . . .

Such an accident, according to science, is what enabled the mollusk to spin out so skillfully the charming object that holds our attention.

Beginning in the germ, we are told, this mollusk, the maker of our shell, suffered a strange limitation of its growth, an atrophy of no less than half its organism. In most mollusks the right (and in the others the left) half has been sacrificed, while, on the other side, the visceral mass bent itself into a semicircle and then twisted. We are told that the nervous system, whose first intention it was to form two parallel networks, crisscrossed strangely and inverted its central ganglia. On the outside, the shell was exuded, and solidified. . . .

More than one hypothesis has been suggested to explain why certain mollusks (and not certain others that are very much like them) develop this strange predilection for one side of their organism; and—as is inevitable in the realm of supposition—what one supposes is deduced from what one needs to suppose: the question is human, the answer too human. This is the whole basis of our famous Principle of Causality. It leads us to *imagine*, that is, to substitute our own machinations for the gaps in our knowledge. But in general

the greatest and most precious discoveries are quite unexpected. They demolish, more often than they confirm, the products of our preferences: they consist in facts that are not yet *humanized*, that no imagination could have foreseen.

As for me, I am perfectly willing to admit that I do not know certain things, and that all genuine knowledge reduces itself to what one sees and what one has power over. If the hypothesis is seductive and the theory is attractive, I take pleasure in them without worrying about whether they are true. . . .

If then we disregard our intellectual inventions, sometimes naïve and often wholly verbal, we are obliged to recognize that our knowledge of living things is insignificant beside our knowledge of the inorganic world. This is tantamount to saying that we possess incomparably greater power over inorganic than over organic things, for I see no way to measure knowledge except by the real power it confers. *I know only what I know how to handle.* For it is strange, and deserving of some attention, that despite so much effort, despite our marvelously subtle tools and methods, we should have so little power over this living nature, *which is ours.* On closer scrutiny we should find, no doubt, that our mind is baffled by everything that is born, reproduces, and dies on our planet, because the mind is strictly limited, in its representation of things, to its awareness of its means of *external action* and of the form this action—*of whose mechanics it need know nothing*—will take.

This type of action, it seems to me, is the only model we can follow in trying to resolve a phenomenon into imaginary and voluntary operations that will at last enable us either to reproduce at will or to foresee a development with some degree of accuracy. Everything that diverges too much from this type defies our intellect (as may be seen in the most

recent physics). If we attempt to force this barrier, we are faced at once with all sorts of contradictions, linguistic illusions, sentimental falsifications; and it sometimes happens that these mythical products occupy and even delight the minds of men for many years to come.

The little problem of the sea shell suffices to illustrate this quite well, and to throw light on our limitations. Since man is not the maker of this object and chance is not responsible for it, we are reduced to inventing something we have called *living nature*. There seems to be no other way of defining it except by the difference between its work and ours; and that is why I have been impelled to say something about our way of doing things. I have said that we undertake our works on the basis of several kinds of *freedom*: freedom with respect to *material*, with respect to *size and shape*, with respect to *time*; the mollusk seems deprived of all these—a creature that can only recite its lesson, which is hardly distinguishable from its very existence. Full of fancy as it may seem (so much so that we borrow certain of our ornamental motifs from it), the mollusk's work, never retouched, unmarred by changes or reservations, is a fancy that repeats itself indefinitely; we cannot even see why certain eccentrics among the gastropods should work leftward where others work to the right. Still less do we understand the oddly shaped complexities that some shells disclose; or those spines and spots of color, to which we vaguely ascribe some utility that escapes us, without even stopping to think that, *outside of man's little intellectual sphere, our idea of the useful has no meaning*. These oddities add to our perplexity, for a *machine* produces no such deviations; a *mind* would have chosen them with some intention; *chance* would have equalized the possibilities. Neither machine, nor inten-

tion, nor chance. . . . All our methods have been rejected. Machine and chance, these are the two methods of our physics; as for intention, it can intervene only if man himself is involved, explicitly or in disguise.

But the making of the shell is lived, not calculated: nothing could be more contrary to our organized action preceded by an aim and operating as a cause.

Nevertheless, let us try to gain an idea of this mysterious act of formation. Let us leaf through some learned works, with no intention of getting to the bottom of them, and without in the least forgoing the advantages of ignorance or of the caprices of error.

I observe first of all that living nature is unable to work directly with solids. In the solid state neither stone nor metal is of any use to it. When nature wishes to turn out a hard article of set shape, a support, a lever, a brace, an armor plate; or when it aims to produce a tree trunk, a femur, a tooth or a tusk, a skull or a sea shell, it works in the same indirect way: it takes the liquids or fluids from which all organic matter is made, and slowly separates out the solid substances it needs. Everything that lives or has lived results from the properties and modifications of a few liquids. And every present solid has passed through the liquid phase, molten or in solution. But living nature does not tolerate the high temperatures that enable us to work with the "elements," to shape molten glass, bronze, or iron into the forms we desire, which will set in cooling. In molding solid organs life has only solutions, suspensions, or emulsions.

I have read that the animal we are examining draws food containing calcium salts from its environment, and that the calcium is extracted and digested by the liver, whence it

passes into the blood stream. This is the raw material for the mineral part of the shell—it will feed the activity of a strange organ specialized in the craft of secreting the elements of the solid body to be constructed and of putting them in place.

This organ, a muscular mass that encloses the animal's viscera and extends to the foot on which it stands and moves, is called the *mantle*, and performs a dual function. Through its *epithelium*, the edge exudes the outer coating of the shell, which covers a layer of very curiously and subtly shaped calcareous prisms.

This gives us the outside of the shell. But it grows in thickness, and this growth involves very different material, structure, tools. Protected by the solid rampart that the edge of the mantle has built, the rest of this admirable organ fashions the refinements of the inner wall, the water-smooth lining of the animal's home. There is nothing too precious or delicate for the meditations of a life so much of which is spent at home; successive layers of mucus spread a coating as thin as a soap bubble over the deep, twisted cavity into which the solitary creature withdraws in concentration. But never will it become aware of the beauty of this retreat it has made. After its death the exquisite substance it has formed by depositing alternately the organic product of its mucus cells and the calcite from its nacre cells will see the light; it will break the sun's rays into their wave lengths, and will enchant our eyes with the tender richness of its iridescent bands.

This, we are told, is how nature builds the dwelling and mobile refuge of this strange animal clothed in a muscle cloaked in a shell. But I must own that my curiosity is not satisfied. Microscopic analysis is a fine thing. But while I am

occupied with cells, making the acquaintance of blastomeres and chromosomes, I lose sight of my mollusk. And if I concern myself with all this detail in the hope that it will ultimately enlighten me about the formation of the whole, a certain disappointment is in store for me. . . . But this perhaps is an essential difficulty—that is, a difficulty arising from the very nature of our senses and of our mind.

In order to imagine this formative process, we must first dispose of an obstacle, and in so doing we automatically sacrifice the inner consistency of our image. For actually *we*—who cannot even perceive our own growth—*are unable to visualize a movement so slow that a perceptible result springs from an imperceptible change*. We can imagine the living process only by lending it a rhythm which is specifically ours and has no connection with *what happens in the creature we are observing*. . . .

Indeed, it seems quite probable that in the growth of the mollusk and its shell according to the ineluctable theme of the spiral, all the components which the no less ineluctable form of the human act has taught us to consider and define *separately*, are *indistinct and indivisible*: the *energy*, the *time*, the *material*, the *connections*, and the different "orders of magnitude" between which our senses compel us to distinguish. Life passes continuously from the molecule to the micelle, from the micelle to the perceptible mass, without concern for the compartments of our sciences, that is to say, for our means of action.

Without the slightest effort life creates a very "generalized" relativity.

It does not separate its geometry from its physics but endows each species with all the axioms and more or less "differential" *invariants* it needs to maintain a satisfactory harmony between the individual and the world around it. . . .

Clearly the rather secretive individual, addicted to asymmetry and torsion, who fashions a shell, has long abandoned the postulates that were Euclid's idols. Euclid believed that a stick keeps its length under any circumstances; that one can toss it up to the moon or twirl it about, and that neither distance, movement, nor change of orientation will detract from its clear conscience as an infallible unit of measurement. Euclid worked on a sheet of papyrus and traced figures that *to him seemed similar*; he saw no other obstacle to the growth of his triangles than the size of his papyrus. He was very far—two thousand light-years—from imagining that one day a certain Mr. Einstein would develop an octopus capable of ensnaring and devouring all geometry; and not only geometry, but time, matter, and gravitation, and a good many other things unsuspected by the Greeks, which, ground up and digested together, provide a dainty dish for the all-powerful *Mollusk of Reference*. This monstrous cephalopod need only count its tentacles and the suckers on each tentacle to feel that it is "master of itself and of the Universe."

But millions of years before Euclid and the illustrious Einstein, our hero, who is only a simple gastropod and has no tentacles, was himself obliged to solve some rather knotty problems. He had his shell to make—and his living. These are very different activities. Spinoza made spectacles. More than one poet has been an excellent civil servant. And possibly two trades practiced by one and the same individual can be kept reasonably separate. After all, what do we mean by *the same*? But we are speaking of a mollusk and we know nothing of his inner unity.

What are our findings? The internal construction is organized in a mysterious way. The secretory cells of the mantle and its edge operate in *rhythm*: the turns of the spiral

progress; the walls are built; the nacre is deposited on them. But the microscope does not show what creates the harmony between the different points and different moments in this simultaneous progress of the whole periphery. The pattern of the colored furrows or bands that curve round the shell, and of the bands that intersect them, reminds us of "geodesic lines" and suggests the existence of some sort of "field of force" which we are unable to discern, but whose action would give the growth of the shell the irresistible torsion and rhythmic progress we observe in the finished product. Nothing we know of our own actions enables us to imagine what it may be that so gracefully modulates these surfaces, element by element, row by row, without other tools than those contained in the thing that is being fashioned; what it may be that so miraculously harmonizes and adjusts the curves, and finishes the work with a boldness, an ease, a precision which the most graceful creations of the potter or bronze founder are far from equaling. Our artists do not derive the material of their works from their own substance, and the form for which they strive springs from a specialized application of their mind, which can be *completely* disengaged from their being. Perhaps what we call *perfection* in art (which all do not strive for and some disdain) is only a sense of desiring or finding in a human work the sureness of execution, the inner necessity, the indissoluble bond between form and material that are revealed to us by the humblest of shells.

But our mollusk has other things to do besides this rhythmic distillation of his marvelous covering. He must supply the mantle which constructs the durable shell with energy and mineral salts; from the resources of his environment he must gather what perhaps, some day in the future, will be a frag-

ment of the foundations of a continent. Thus he must sometimes forsake his secret, subtle work of emanation and venture out into the world, bearing his dwelling, his den, his fortress, his masterpiece, like a wondrous tiara or turban. At once he is involved in an entirely new set of circumstances. Here we are tempted to credit him with a genius of the first order, for he must confront two utterly different realities accordingly as he closets himself in laborious, concentrated aloofness to co-ordinate the efforts of his mantle, or as he ventures out into the vast world and explores it, his eyes groping, his feelers questioning, his firm *foot* with its broad viscous sole supporting the majestic traveler and his sanctuary, rocking them to and fro. How is he to combine, under a single set of principles and laws, the two kinds of consciousness, the two forms of space and time, the two geometries, and the two systems of mechanics with which these two modes of existence and experience alternately confront him? Perhaps when he is all inside, he takes his spiral arc for his "straight line," just as we take for ours a little arc of a meridian, or, unaware that its trajectory is relative, a ray of light. And perhaps he measures his private "time" by the sensation of secreting a little prism of calcite and putting it in place. But once he leaves his shelter and takes up his outside life, heaven only knows what hypotheses or conventional rule of thumb he lives by! . . . The mobility of the feelers; the touch, sight, and movement associated with the exquisite elasticity of the wonderfully sensitive shafts by which they are oriented, the perfect retractility of the body of which the whole shell is an appendage, the binding obligation to skip over nothing, to adhere strictly to his path—all this is bound to move a gifted mollusk, when he withdraws from the world and buttons up once more in his case of nacre, to profound meditations and

radical synthetic abstractions. He will need what Laplace rather pompously called "the resources of the most sublime analysis" if he is to adjust the experience of his worldly life to that of his private life. He will have to reason profoundly if he is to discover "the unity of nature" underlying the two so different aspects between which his organization compels him to alternate.

But do we not, ourselves, fluctuate between "the world of bodies" and that of the "mind"; and all our philosophy, is it not an eternal quest for the formula that will efface the difference between them and reconcile two divergent orders, two systems of time, two modes of transformation, two types of "forces," in short, two frames of reference which thus far have seemed, the more closely we examine them, to become more and more distinct, though concomitantly more interwoven?

In a more immediate order of things, far from all metaphysics, do we not make ourselves at home amid the most irreconcilable disparity of sensory experience; do we not, for example, accustom ourselves to a visual and an auditory world which resemble each other in no way and which, if we thought about it, would give us a perpetual impression of perfect incoherence? Of course we say that such an impression is effaced, fused as it were, by custom and habit, and that the parts join to form a single "reality." . . . But with this we are not saying very much.

I shall throw away this thing that I have found as one throws away a cigarette stub. This sea shell has *served* me, suggesting by turns what I am, what I know, and what I do not know. . . . Just as Hamlet, picking up a skull in the rich earth and bring-

ing it close to his living face, finds a gruesome image of himself, and enters upon a meditation without issue, bounded on all sides by a circle of consternation, so beneath the human eye, this little, hollow, spiral-shaped calcareous body summons up a number of thoughts, all inconclusive. . . .

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[The subject entries summarize Valéry's basic ideas about aesthetics but do not employ all of the various terms that occur in the text. The letter *n* refers to the textual notes on pp. 281–98; e.g., "3*n*" will be found on p. 281.]