

Science and Spirituality – Finding the Right Map

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Every object, well- contemplated, creates an organ of perception in us.

Goethe

INTRODUCTION

We begin with a remark concerning why it has proven so difficult to clarify the status of spirituality and its relation to science. In part, we think, it's due to a confused cartography, a false map. That map looks something like this:

<u>Faith.....vs.</u>	<u>Reason</u>
<u>Belief.....vs.</u>	<u>Knowledge</u>
<u>Religion...vs.</u>	<u>Science</u>

In one column we have faith, belief and religion. In the other, opposite faith many people would place reason. Following that logic, in contrast to belief we'd have knowledge, and opposite religion, science. This common scheme is not entirely mistaken. It provides a useful set of distinctions, certainly for our public and social life, perhaps even for aspects of our intellectual life. The faith/reason interplay and debate have endured for centuries, possibly since the time of the early Church, and certainly since the Reformation.

However, we do not wish to explore the classic tension between religion and science, faith and reason. Instead, we will focus on the following three questions: first, the status of spirituality—the spiritual life, the spiritual dimensions of our lives and our world. Where are these to be located in this map? Second, what is the relation of spirituality to science? This question invites a review of our perspective on science itself. Third, following on the latter point, might our understanding of knowledge or “knowing” be enhanced or enlarged? Should we really rest content with our conventional notions of the nature and limits of “knowing”?

Regarding the first question, the nature and status of spirituality, the common assumption will be that we must choose a side for it on our little two-column map. It's a classic “either/or” situation. It appears we must place spirituality either on the side of faith or of

reason, belief or knowledge, religion or science. And of course the common choice will be the faith/belief/religion side.

Even this first step, crediting the presumption that we must *choose* one side of this proposed divide, seems to us a fundamental error, one that already yields a false map. We believe that some significant aspect of “spirit” actually resides on and animates both sides of this mapped polarity. Now, inasmuch as spirituality certainly lives within the first column of our map, the column that includes religion, it can figure prominently in the ethical sense of an individual or a community. But it does so by drawing upon a kind of knowing, rather than on a religious tenet (which might well express spiritual knowing in particular, tradition-specific terms). We therefore take spirituality to be the more fundamental case, and thus more suitable for our discussion of possible links and contrasts with science.

We should acknowledge in passing that the distinction between religion and spirituality may itself seem debatable, since the two coincide in many people’s practice. We hope the reader will grant us leeway to concentrate on a line of thought we feel requires the distinction, at least up to a point. And expanding on our claim that spirituality does have a place on both sides of the map we’re examining: spirituality may be distinguishable from religion, but it certainly should not be defined in such a way as to relegate it to a separate, circumscribed niche. For us, spirituality is a term which bears on the most encompassing view of life and human engagements. Our objective is therefore to provide an account of how this may be so. Following advice given by Owen Barfield, we seek to distinguish, but not to divide. (Barfield, Owen 1971)

Now, what basis could there be for including spirit and spiritual life in the other column of our map, the column we’ve characterized as emphasizing inquiry, reason, experience leading to knowledge, science? Sciences like physics are taken to be ultimate expressions of disciplined inquiry and rational analysis. What possible connection could they have to spirituality?

This same kind of question arises regarding many other dimensions of our lives, aesthetic, ethical and moral. Where should we locate these on our little map? Following the map’s apparent logic, they might seem to involve only feelings, subjective impressions and opinions. That common assumption notwithstanding, might they actually be more akin to knowledge? How? In this essay, we want to step away from specific developments within science and religion, aesthetics and ethics, and argue instead for an acknowledgment of their common root. We maintain this root consists in a *common cognitive source*—specifically, an active and refined use of appreciation and insight.

It is precisely such capacities that constitute the heart of science and the quest for knowledge. If we omit them from our definition of either spirituality or the knowledge-project, we will have arbitrarily defined out much of what we care about the most. By including the role of insight, we recover a sense of the basic nature of all the items in our little map, and can find a more satisfactory way to redraw it.

II. Seeing a Sunset

Imagine that we are standing on a hillside in some natural setting, viewing a sunset. The sun will soon dip beneath the horizon, and some clouds hang low in the sky. The sky overhead remains an intense blue. But as the sun sets, both the landscape and cloud-filled horizon are wonderfully transformed by a series of shifts in color. The last streaming sunlight dances across the landscape, and the clouds show first, perhaps, the tenderest touch of pale yellow, and then gradually change over the course of some minutes to an increasingly intense orange and then red. Not only the clouds, but the entire landscape before us is thus transformed. The sunset scene makes a powerful impression, aesthetically, perhaps even spiritually, fascinating us and drawing us into a deep rapport with the world, with various facets of our existence as they're felt in this special moment.

While we're immersed in this experience, a certain kind of thought might intrude: "This display is remarkable, spectacular, and the moment—the engagement—meaningful in some elusive way." So it's natural for us to wonder, "Hmm ... what is present here? What is *happening* here?" That question, which is concerned with large matters of existential significance as well as intellectual curiosity, might then be further sharpened to concentrate on natural processes: "*How* does this happen?" And then further, "what is the scientific mechanism?"

The easy, unconscious restatement of our wonder as a request for a predictive or causal account of a phenomenon is a fairly modern quirk. We should be aware of the steps taken here, and of both the enormous advantages and the somewhat regrettable tradeoffs. The advantages are obvious to us at this point in history, but the tradeoffs have become harder to appreciate or even define, and so they now seem negligible, "metaphysical."

Can we remember when we first asked things like, "Daddy, why is the sky blue?" or, "Why is that cloud so red?" Then too, our questions may have been pointed, concerned with some observed particular that struck us as remarkable. Through our questions, we sought answers that would help us deal with what we were meeting directly in the world. We wanted to clarify this meeting so we could turn back to it with greater acceptance and appreciation.

This orientation towards questions and answers—and omniscient mothers and fathers—seems so natural for children as they relentlessly quiz their parents. It's doubtless naïve in some respects, but it nevertheless retains a connection to an issue that is important for us all. Let's see how might it have been respected and served if our hypothetical parent were a scientist, or scientifically informed. How would "daddy's" patient explanations have sounded, and how would they have addressed our original concern, if offered at various periods in these last few, increasingly scientific, centuries?

In the 18th century, daddy might have said something like: "Well Mary, light is really made up of tiny corpuscles or particles; and the big ones give rise to red sensations, while

the small ones yield blue sensations. And as these particles stream through the clouds, you see, the blue ones are absorbed and the red ones get through.” So an 18th century Mary would be expected to consider her untutored perception of the red sunset in terms of that explanation and think “Oh, that’s the reason the sunset clouds looks red—only the red particles are reaching me.”

This kind of explanation, due to Newton, served well for quite a while. But scientists gradually began to realize for various reasons that the corpuscular model is not a satisfactory way of thinking about light. So another picture then came into vogue, to the effect that “light is a wave.” Specifically, that light is a wave within something that used to be called the ‘luminiferous ether.’ This view was especially popular in the late 18th and early 19th centuries, and persisted right through the 19th century.

The luminiferous ether was conceived to be a subtle material body which pervaded all of space. It could support light waves, in a manner similar to the physics involved in sound propagation through air. The waves traversed the luminiferous ether, which spanned the distances intervening between objects and observers with waves, reached our eyes ... and so we could see. And, again, there was an attendant explanation of the color differences: the long wave lengths and the short wave lengths give rise to the different colors, some being absorbed and some not, *et voilà*—a magnificent sunset!

Again, a happy resolution of at least some aspects of Mary’s concern—but only until scientific research failed to support this ‘luminiferous ether’ notion. In the wake of the justly famous Michelson-Morley experiments, we scientists reluctantly rid physics of the ‘ether’ altogether. But we still liked the ‘wave’ idea, and it was in fact a very powerful way of thinking. Only, what then was waving? If there wasn’t any water or air or ether ... there was just nothing there. Try to think that thought—something is waving, but there’s nothing there to wave, no medium. So, it’s like trying to catch a wave and surf your way in to the beach, only there’s no water to carry you. We are dealing here with an entirely different conception of the wave nature of light.

We might say that we have shifted from an ontology of matter (be it corpuscles or ether) to an ontology of force. This mysterious thing called light, which used to be considered as particulate, and then as luminiferous ether waves, is now recast as electro-magnetic waves, waves within something called the ‘electromagnetic field.’ Even if this field is still seen as analogous to the discarded “etheric medium” of the past, the crucial difference is that in this case it has become more abstract and requires a primarily mathematical treatment. Michael Faraday suggested a nonmathematical version of this sort of shift forty years before experimental data necessitated such a change in thinking. James Clerk Maxwell developed the abstract theory for it in the 1860’s.

The ‘electromagnetic field’ is an extremely powerful conception in physics. In fact, it was so remarkable that even the originators of this concept such as Maxwell and Lorentz could not quite bring themselves to accept its implications fully, and so clung to some kind of ether hypothesis. (Zajonc, Arthur 1993) It was really only after these great physicists died and we were well into the 20th century that the “ether” was finally

abandoned, and electromagnetic waves were accepted as traveling through space without the support of a material medium.

Of course, by the turn of the century, the specific issue of sunset colors could already be explained by Mie scattering and Rayleigh scattering. Here the basic idea involves the incidence of electromagnetic waves on polarizable particles in the atmosphere, which sets up little electric dipoles that oscillate and give off their own electromagnetic waves. These secondary fields interfere with the original incident waves, with the result that the differential cross section depends on the fourth power of the frequency of electromagnetic wave's vibration. This is all very complex but works beautifully ... at least until we start thinking about light from the perspective of quantum mechanics!

Remember where you are on the hillside, entranced by the sunset, holding a poignant question about it that's prompted by your elation and curiosity. Perhaps you are disappointed or annoyed by the answers your solicitous parent is offering, and feel that they miss your point. Perhaps you're feeling distracted and hope daddy won't tell you any more about this physics stuff. Or perhaps daddy's skillful summary of physics exposes you to more marvels than even your original experience and question encompassed, and starts you on the way to your own scientific calling. Perhaps both of these reactions arise, leaving you feeling subtly torn.

So, as we gaze enraptured by the sunset, the scientific answers may seem irrelevant to us. Or they may help us to appreciate its glory and the wonders of the world's phenomena even more. They may even accomplish the latter splendidly and still miss something important. Much depends on how the scientific view itself is understood, the extent to which it's taken—or presented—as an exercise of insight and an aid to appreciative participation in the phenomena.

We must remember that even the electromagnetic conception we've described is still only physics circa 1905, a hundred years ago. Quantum mechanics and quantum field theory have since arisen and added to our understanding of light and its interaction with clouds, so the electromagnetic waves, which we thought of as unsupported waves of the energy of the electromagnetic field, have since been reconceptualized in terms of a quantized field in which photons are created and destroyed in the scattering process.

So for us living in the 21st Century, answers have become quite abstract. “And yes, Mary, *that's* the reason why the sunset sky turns red! That's what's really happening here.”

III. Science is Wonderful... But What is it?

Physics is a very beautiful field. It is the love of my intellectual life, especially this area last mentioned above, quantum optics.) Overall, what has been briefly sketched here is part of the real story of how physicists have understood light since the 18th century. It's clearly an elaborate and marvelous theoretical framework, one which has changed repeatedly to give us the best account of light we can manage at any given time. And it's very illustrative of the scientific enterprise in general. Note that while science yields an

account, this process of explanation may never be fully completed ... so far, it has kept changing, undergoing refinement.

The first and simplest lesson we should probably draw from this story is that it's best to be modest in our pretensions to understanding the world. And it's not just that we ordinary mortals don't understand, for example, the nature of the light that streams through that beautiful sun-lit landscape. Even Albert Einstein was keenly aware of his theory's limits. In 1917, when as a young scientist he had finished his papers on both special and general relativity, he set a task for himself: (Wolf, Emil 1979)

"For the rest of my life I will reflect on what light is."

And decades later, not long before he died: (Wolf, Emil 1979)

"All the fifty years of conscious brooding have brought me no closer to the answer to the question of what are light quanta. Of course today every rascal thinks he knows the answer, but he is deluding himself."

Whether or not physics undergoes radical change indefinitely, we can be quite certain that our last account, which reflects the most modern physical theory about the light quanta—even that will continue to be refined, and probably will be overthrown in radical ways. But while this theoretical evolution is of tremendous importance, and leads to profound understanding, what is the nature of this understanding? What does it really involve, all along the way? What fuels it, what does it yield for us, and what might it obscure if we're not careful?

Returning to the sunsets—both they and our human visual capacity, perhaps even our actual appreciation of their colors and beauty, have been the same for millennia. Even granting that differences of culture, language (including color terms and color categories) and worldview are also involved and doubtless influence certain features of our appreciation, we believe much has remained the same, especially at the fundamental level: recognizing the basic colors, feeling a sense of wonder and curiosity and connection. On the other hand, in the past three hundred years physicists have certainly produced a fascinating series of quite different accounts of sunsets' splendors.

The process of doing science is largely about generating models for things like light—for what light is, how it interacts with the atmosphere, and so forth. Without model-making, there could be no science. However, if we take this particular aspect of scientific praxis too literally, and if we focus on the model-making enterprise itself too exclusively, we then make the mistake mentioned earlier—we define the search for knowledge too narrowly.

What is essential, and thus proper, in our model-making, our theorizing? This question might help us find the right way to handle theories, one that frees us in certain respects. Obviously we can't renounce the use of formal theories; we will remain scientists in that sense. But perhaps we can and should handle such theories more lightly, without

exaggerated commitments. If we see that this is so, we may then move easily from one theory to the next, always being prepared for further advancements or refinements.

Even more importantly, we may come to a new view of our knowledge projects, a way of understanding what science is really about, that could accommodate the aesthetic, ethical and spiritual dimensions of our lives. But if we define science as the only knowledge project, and as being primarily concerned with models, all knowledge is captured within or restricted to those models. The knowledge project is then—we think unfortunately—reduced to the modeling project. And we thereby also leave out some other, very important aspects of both the phenomena and the scientist qua knower.

IV. Early Modern Articulations of “Really Knowing”

In 1851, Henry David Thoreau stood on a hillside, viewing just the sort of sunset we’ve been discussing. It was Christmas evening. And he writes in his journal: (Thoreau, Henry David 1906)

“I, standing twenty miles on, see a crimson cloud on the horizon. You tell me it is a mass of vapors which absorbs all other rays and reflects the red. But that is nothing to the purpose. What sort of science is that which enriches the understanding, but robs the imagination? If we knew all things thus mechanically merely, should we know anything really?”

Here Thoreau alerts us to a major tension, a contrast he describes as holding between “understanding and imagination”. At stake here is the difference between a form of understanding which he calls ‘mechanically merely,’ and what it would be to comprehend something incisively and satisfactorily. Thoreau seeks more than just to know via a narrow preoccupation with the models and postulated mechanisms of physics. He wants also to know through what, in the parlance of his time, he calls the faculty of imagination.

The “imagination” that Thoreau so prized—and which he claims might reveal the sunset to him more fully than a mechanical account by itself—certainly also has a central and active place in the life and practice of a scientist. By clarifying this faculty’s nature, scientific role and relation to the world, we may establish that science does more than proffer merely mechanical accounts. Thoreau’s friend and mentor R. W. Emerson raises the challenge succinctly: (Emerson, Ralph Waldo, 1903-04)

“And never did any science originate, but by a poetic perception.”

Despite the great difficulties involved in defending such an assertion, we think what’s at stake is so important that we must reopen the inquiry—how might Emerson have been right? Note that what lies behind his point applies to commonplace insights and sensibilities, ethico-spiritual and aesthetic responses, philosophy, and to the practice of science. Much has changed since the romantic philosophical vision of Emerson and

Thoreau. And of course our contemporary view of nature and science cannot possibly be traded away for a return to those 19th century yearnings. But still, Thoreau and Emerson also offer us glimmerings of a critical and timeless issue.

We find related clues in other authors, cultures and periods. Thoreau and Emerson struggled to articulate and defend a point that for them and many others over the centuries has remained inchoate, an awkward fledgling. Now its explication must be made more mature, and integrated more fully into our modern understanding. Much new work is needed, but it should not be undertaken without acknowledging the early but extremely provocative attempt by Johann Wolfgang von Goethe.

Goethe was a genius of an unusual kind, who sought a harmony of view concerning the scientific, poetic and personal domains. He made a remarkably concerted attempt to engage the question—how we can understand science and the knowledge project in general, in ways that would also be open to the spiritual dimensions of our lives? Like Thoreau and Emerson, Goethe saw this as not only desirable, but essential.

First of all, Goethe was critical of the model-building enterprise as an end in itself. In his *Theory of Colors* he wrote: (Goethe 1970)

“The investigator of nature should take heed not to reduce observation to mere notion, to substitute words for this notion and to use and deal with these words as if they were things.”

And a short essay on science Goethe stated: (Goethe 1952a)

“A false hypothesis is better than none at all. The fact that it is false does not matter so much. However, if it takes root, if it is generally assumed, if it becomes a kind of credo admitting no doubt or scrutiny this is the real evil, one which has endured through the centuries.”

In the terms of our example, we’re standing there on the hill in the early evening, immersed in our experience of the sunset, but we unconsciously drift from its vibrant presence to words, notions, concepts. And then we deal with those concepts and words as if they were the thing itself. So in fact, we’ve stopped looking. Unless we’re aware of these concepts’ limits and their source in our capacity for insight, and are careful to note ways they may aid our direct participation and enlarge our discernment ... we’re effectively not there anymore.

The same dislocation and truncation of appreciation can occur in many other domains, even the interpersonal sphere. When looking at one another, we sometimes see only in terms of social conventions, memories and descriptions, words and concepts, and perhaps ideas drawn from psychology, politics or medicine or a hundred other disciplines. We

meet, understand and interact with each other in a way that's very complex, but remains "mechanically merely," as opposed to *really*.

Over the course of his life, Goethe went to great pains to explain why, both as scientists and as human beings, we must avoid this mistake. From his standpoint, the problem is not that we use a description, convention, model, or hypothesis, but rather that it acquires a dominating force. (Magnus, Rudolf 1949)

"Hypotheses are like the scaffolding erected in front of a building, to be dismantled when the building is completed. To the worker the scaffolding is indispensable, but he must not confuse it with the building itself."

Models and hypotheses are like scaffolding ... don't confuse the scaffolding with the building itself. Once we've succeeded in raising the mature insight, we must take down the scaffolding so we may see the building directly. Doubtless we need stepping stones, intermediate stages, conceptual aids, in order to gain a fuller and more direct view, a direct engagement with the building. But we shouldn't confuse the latter with any of the former.

Here Goethe uses a wonderful German word, '*das Wesen*'. He says: (Goethe, 1981)

"Yet how difficult it is not to put the sign in place of the thing. How difficult to keep the being (das Wesen) always livingly before one, and not slay it with the word."

We must gain and retain access to what he calls *das Wesen*, the being, the building itself, whose character is reflected in the theory or scaffolding, but should not be equated with the latter at all, and is thus not limited to the narrow, antiseptic version of what we moderns typically consider a "phenomenon." So we honor theory and the theoretical enterprise of normal science, but at the same time we don't want to adopt a fundamentalist attitude toward that science. We don't want to interpret *knowing* and *knowledge* of a thing as being equivalent to our possessing a scientific model of it.

We seek an approach to science that is honest about its nature and sufficiently respectful of the world being studied that it can accommodate more of the phenomenon's actual character. Granted, this agenda is both complex and problematical, possessing many controversial points. But these difficulties should not intimidate us into settling for less without even considering the possibilities. And by this commitment, spirituality may also be accommodated—not as involving only faith, but as part of the knowledge project, as relevant to true knowing.

Goethe's own work contains some useful hints about how this might be achieved. In addition to being a great romantic poet, Goethe also made many significant contributions to the study of color, plant morphology and human anatomy. His approach to these apparently quite disparate fields exhibits a vision which was clearly indebted to his study

of novelistic technique. Drawing upon that experience, he says that attempting to formally define the inner nature of a thing is not the only or best option. (Goethe, 1995a)

“What we perceive are effects, and a complete record of these effects ought to encompass this inner nature. We labor in vain to describe a person’s character, but when we draw together his actions, his deeds, a picture of his character will emerge.”

Goethe, the novelist and playwright, knows one doesn’t capture and convey a person’s character by trying to define it, but rather by *showing* it, enabling the reader to directly apprehend that person’s actions and responses to life. Confronting first the effects or actions, we readers can eventually come to see more, the person. Turning his attention towards Nature, Goethe retains this same conviction. A person must do her job as an observer, as an empiricist, and one could say, as an experienter, knowing that she can’t just open her eyelids and let the whole world flood in and be known. One must engage the world actively and systematically, seeking out its effects, and then the phenomenon will begin to reveal itself more completely and coherently. Its nature will shine through its effects. Attaining a more full and incisive cognizance of these effects is the goal of applying the scientific method.

In dozens of treatises and also in his correspondence with Friedrich Schiller and others, Goethe explored this view’s application to science. While modern science and philosophy obviously supercede much of that 18th century account, we think Goethe saw and emphasized an important point that nowadays tends to be lost. (Goethe 1995b)

“There is a delicate empiricism which makes itself utterly identical with the object, thereby becoming true theory. But this enhancement of our mental powers belongs to a highly evolved age.”

This is an extremely condensed statement of many of Goethe’s ideas about science. “A delicate empiricism”—there’s a way of engaging the world of phenomena, the world of experience, which is both fully active and delicate. We thereby make ourselves “utterly identical with the object” of study, we move into the phenomenon, we don’t stand off at arm’s length. We maintain the best kind of objectivity when we engage and become identical with the phenomenon. And thus we “become true theory.” What could Goethe possibly mean by being identical with the object, by becoming true theory? Aren’t we separate from the objects of our knowing? Isn’t a theory just a formal statement, a generalization, an abstraction?

Goethe says that true theory, true knowledge, arises for us in that moment and through that delicate empiricism, because by staying with the phenomenon, insight into its fundamental nature may arise. This more participatory form of insight is what he calls “the aperçu.” And then he cautions, “But this enhancement of our mental powers belongs to a highly evolved age.” A person can’t just passively acquire the aperçu. First we must work to enhance our powers of discernment. As a physicist struggling with a scientific

challenge, or as a person seeking maturity or moral integrity, we must evolve, developing new capacities of insight so we may integrate more fully with the phenomena of life as they actually present themselves.

This very brief account of an alternate view of the knowledge project posits that knowing is more capable of refinement and discernment with respect to the phenomena than is usually supposed, and thus need not be set altogether apart from more spiritual forms of beholding. Applied to science, this view does not overemphasize theoretical models, but rather respects the cognitive source that gives rise to them and also, in the end, completes them.

V. Developing our Capacities to See.

The tension between the theory and presuppositions of modern science, on the one side, and the alternate possibility of a science—or a new approach to ordinary science—based more on insight, is itself creative. It can challenge us to clarify both perspectives, examining each with the other in mind. In the process, we may also begin to see our way to a bridge between ordinary science and other domains of knowing, and even significant fundamental overlap between them. The common element is an *active* insight that is appreciative, intimately connected with its object through a process of rigorous engagement and exploration

Some psychological research has also centered on the phenomenon of figure-ground reversal, and other ways in which we can switch between two views of an ambiguous figure. The reader is probably familiar with the picture above, in which one can make out either the face of an old woman seen close up, looking to the left, or the profile of a young girl at a distance turning away from the viewer (her chin becomes the old woman's nose, her necklace becomes the mouth).



Ambiguous figure—an old lady or a young maid

Our present interest in such ambiguous materials should not suggest that we think the world itself is usually so ambiguous, but only that they illustrate the role of active decisions and selective attention in perceiving. While not ambiguous, the world is rich in content and features on many levels that may be of interest for various reasons. And the discernment of specific phenomena in that rich presentation depends on both our attention and our sensitivity. The latter are themselves iteratively informed and refined by interaction with the world, with received knowledge and with the theories (“scaffolding”) we may fashion to represent such complexities. Our own degree of maturity and personal development in appreciating the possibilities are also involved in “insight.”

This was Goethe’s point—*what is the real, or essential, phenomenon?* We must practice something like his method to bring out the real phenomenon so that we may appreciate it better. And having done this in the classroom, or by thinking deeply, reading or watching some instructive film or television program at home, we must then practice seeing instances of that same phenomenon in the world at large. Only thus may we truly cultivate a fundamental “insight” and may we expect to find a corresponding enrichment in our own selves, in our way of being, as a result of entering the world more appreciatively.

True beholding, true theorizing, requires the active cultivation of an appropriate sensibility. Goethe says: (Goethe, 1995c)

“Every object well contemplated creates an organ for its perception.”

Working our way into a deep engagement with the world, using care and contemplation, eventually creates an organ for perception, and changes us in the process. This is as true of the artist as it is of the scientist. And it applies equally well to the spiritual

contemplative, or to anyone seeking to be a better person in the spiritual sense. In any of these spheres, such disciplined engagement and contemplation yields a deepening of capacity and maturation, enabling us to see more of what is there.

One delightful story to this effect is about Paul Cezanne, the great post-impressionist painter. Over the period of a generation Cezanne made many studies of Mont Sainte-Victoire near Aix. And the story has it that his son found this repetition incomprehensible, and asked, “Father, why are you painting the same thing?” And Cezanne’s not very forthcoming reply was “I could stand here for six months and paint this scene again and again and again.” In a letter to his friend, Emil Bernard, he essentially said: (Cézanne, Paul 1976)

“Nature is the true teacher, and we must make ourselves concentric to her.”

This “becoming concentric” is quite a wonderful notion. The point is partly that we start out *eccentric*, “off-center.” And then through that constant patient inquiry by which something is well contemplated—as Goethe put it—not only do we paint pictures or contrive models, but we actually find the world. We create new organs of perception; we make ourselves concentric to that which we are beholding. When we finally succeed, an element of true theory is made plain. And perhaps we also find something of ourselves in this engagement with the world.

In discussing this idea an anecdote about Rilke comes to mind. Rilke passed through an exhibition of paintings, and standing before a painting by Cezanne, felt at a loss for quite some time. But finally his capacities became adequately sharpened by the encounter, and then Rilke is rumored to have exclaimed:

“Ah, now I have the eye and I can see it!”

To some extent we are advocating a new approach to knowledge, different from that of standard science. In the sense that we can all follow Goethe’s methodology in various domains without necessarily converging on the kind of stance, concerns and technical features of standard science. But because the essence of Goethe’s approach is the refinement of engaged insight, and we maintain that this stands at the center of science too.

What we find most important about Goethe’s ideas is his realization that without turning away from our engagement with the world, we can ascend from initial, unfocused and naïve impressions to a direct appreciation of an archetypal phenomenon (Urphänomen). This is not *metaphysics*, but rather the opposite—enhanced, appreciative *presence*. Especially concerning what we take to be “real” or of the greatest relevance, we should

not then look for something further behind that Urphänomen. However, Goethe was well aware that: (Eckermann, 1964)

“... the sight of a primal phenomenon is generally not enough for people; they think they must go still further; and are thus like children who after peeping into a mirror, turn it round directly to see what is on the other side.”

We suggest that this caution applies to science as well, but not that science itself is intrinsically misguided. Science need *not* make the mistake of “looking behind the mirror,” attributing existence to its models and theoretical terms. And once the basic phenomenon is discovered, there *is* still more we can legitimately do as scientists—Goethe’s cautions do not rule out the further development and proper use of models.

Goethe’s approach thus stands in a complex but complementary relation to the scientific theories we summarized earlier in this paper, where the stated objective is often thought to involve *just* the framing of a successful candidate for an underlying mechanical or efficient cause (such as Rayleigh and Mie scattering). Many of the same terms Goethe mentioned still figure in such a standard scientific account, but with a different emphasis: we start with light and optics (rather than with the human eye and its interactions with light, as in Goethe’s case), and again there’s a turbid medium affecting the light’s passage, etc. But we then also move on to the search for a model that predicts which wavelengths of light will be seen under particular conditions. So in the case of the sunset, long wavelengths of light are predicted because the short wavelengths are understood to be scattered away.

Goethe would respond that while this might or might not be true (and it really might be true!), it’s missing an important point ... what we’re always dealing with, first and foremost, is an actual encounter, an arrangement of phenomenally engaged entities. More specifically, we’re confronting perceived relationships between these entities, not just analyzing them in isolation (a situation which can never really exist) or hypothesizing things and workings that *may* lie behind them. The fact that we *can* gain fundamental insights about phenomena without leaving them or our engagement with the world behind is a major discovery. Our reading of Goethe suggests that it is an important aspect of any real understanding, particularly that which is involved in science.

Insight's greater scope can be useful and important. This is precisely the point we sought to make by raising the example of the small girl, gripped by both wonder and curiosity as she witnessed the sunset's display of colors. Her father's explanations, drawn from physics, may address part of her interest. And Goethe's own color theory and methodology can also help along similar lines, as we've indicated with our summary of his account.

But we believe Goethe's point goes farther than that, in ways that address other features of the girl's interest. It's not just a supplement to the standard scientific way of *explaining* certain colors or characteristics of the sunset which might have caught her attention. It is not even limited to looking at the same phenomena, in some sense, or to "phenomena" at all. For it is intended to aid our direct participation in a larger context, discovered by more emphasis on what is "actual" and apprehensible by mature sensibilities. This context has been called the "Being" dimension by some modern Western thinkers. The phenomena and the situation in which they manifest would thus be seen as an expression of Being, not just of physical principles and causal connections.

At least an incipient understanding of Being was probably involved in Goethe's concern for balance between science and human values, and in his emphasis on always keeping "the being" (das Wesen) "livingly before" us. The ordinary ontology explored by science, or even defined by it, may itself come to be seen as an excerpt from a more fundamental ontology of Being. The latter also seems to be the source of some aesthetic, value-oriented and spiritual sensibilities. Goethe commented that he who has art and science has religion also.

Here we find ourselves at the crossroads, facing two intersecting and inseparable worlds—one supporting propositional meanings, the other sheer meaningfulness. Since this latter dimension is found within manifest phenomena, our awareness of it can easily be heightened by the latter, especially in situations of particular beauty or which carry a strong existential charge of various sorts. Moreover, the experience of Being does not seem to be a mere affect, but—like science—bears on issues of ontology.

VI. Examples

Let's consider some examples. Suppose you are interested in the phenomenon of motion. You might find a small dense object like a ball, and throw it upwards, catch it, throw it from hand to hand, and toss it to someone else, catch it, and so on. You'd probably notice that these motions involve trajectories and velocities, and also depend on the object's weight. But throwing and catching and tracking paths of motion are all pretty intuitive, and so you might stop there. This would be an example of a preliminary, naïve engagement with the phenomenon.

If you happened to become more curious about the laws of motion, you might persist, examining the phenomenon more systematically, to determine its essential features and conditions. How hard do you throw the object? Does it make any difference if the air is

removed from the room? How do size, shape, and weight affect the motion? Various factors of this sort can be tested; data can be collected and analyzed. And you might even begin to formulate some descriptions or mathematical equations that summarize the data's correlations.

However, the latter enterprise of quantitative treatment and theory-formation is best kept in relation to something else—fundamental insight. Insight suggests the theories, but also brings us into an increasing intimacy with the phenomenon itself, eventually penetrating to the recognition of its essential character. We discern the fundamental phenomenon that is expressed within the particular effects.

For the case of laws of motion, particularly planetary motion, one of the early modern scientists who unconsciously followed this exploratory path with great success was Isaac Newton, whom Goethe criticized for overemphasizing the abstract side of science, and who did in fact originate the modern quantitative, formal and abstract approach to science that Goethe opposed. But while Newton developed this now-standard approach, he also necessarily drew upon the same source that concerned Goethe. Consider, for example, Newton's discovery of what we call the universal law of gravitation.

The young Newton had left Cambridge and returned home to Lincolnshire to avoid a plague that was raging at the time. This several-year break from school constituted what he called the "miraculous years," during which he claimed to have had all the best thoughts of his life (an assertion that might have disturbing implications for college teachers).

Imagine Newton out in his yard, picking apples or whatever he was doing during this time off from school, when something remarkable occurs. (At least, this is the legend, and Newton was one to supply the legends and help them along.) An apple dropped from a tree, and Newton says that when he saw this fall, he simultaneously saw that it was *the same thing* as the moon passing slowly overhead. Note that he hadn't derived any equation. He just saw a basic similarity. The moon's motion around the earth, which he had been pondering, he saw in that moment to be the same as the apple falling. Now, if you're like most students of physics—you'll probably find it very hard to see such a thing. The point is far from obvious. But he saw it. Can you imagine the exhilaration of suddenly entertaining this thought, through the power of insight—that the motions of the world and of other worlds all work this way?

Remember, he hadn't made a computation yet. To prove his point, in general, he had to invent the calculus (which was also accomplished during this same vacation from school) and also do much more theoretical work to formulate the issue in precise, scientifically cogent terms. So to convince himself and his colleagues, he needed formal definitions and tools that hadn't even been invented then, but still, he definitely saw something essential. In Goethe's terms, Newton had become so directly and insightfully connected to his experience, he participated in some fundamental feature of the apple's fall. And at

that moment, since he had been so concerned with celestial motion, like that of the moon around the earth, he also saw these two things as the same in some important sense.

This is the kind of moment for which physicists live. And in essence, it bears on what we *all* live for, whether we're scientists or not. A person doesn't become a physicist in order to solve differential equations, or to play with quantum field theory; the latter are just useful tools, aids to an enriched understanding and appreciation of the world. A similar point applies to musicians, or builders, or politicians, or teachers or parents. What we really seek is enhanced, appreciative participation in the significance of life and the world.

Another example from my own personal history made an enormous difference to my own understanding of these matters and to my own priorities in life. In 1975, when I was a graduate student, I and two other students were working on a problem in atomic physics, time-of-flight analysis of electron impact excitation of helium to metastable states to be exact. This problem seemed intractable—the time-of-flight spectra could not be analyzed. I had read the literature on the subject and found no help. One night I told my wife Heide that I was going out for a walk, and then I went out the door and started strolling down the dark street. Soon an image started to form in my mind, a growing sense of a pattern. And I saw all the different geometrical features of the problem clearly ... things hung together in a way I'd never seen before. And of course part of my excitement was that no one on the planet had ever seen them before either. Thousands of students repeat some of Newton's experiments every year, straining to see what he had, but in this case, I was the lucky first.

The next day, I tried to explain my insight to my advisors, and struggled to convince them that it really did make sense. And eventually I noticed something happening to them too—they began to put aside their old ways of thinking, and to *see* it with me. Now, we didn't have a new language or set of conventions to discuss my idea properly in the formal sense. We stumbled around with the old language, and scribbled and drew on the blackboard, but we didn't have a derivation, only a "co-seeing," a growing convergence in joint participation. And then at a certain point, we were all there together. This was tremendously exciting. Our work acquired a heightened form of meaning. And in my opinion, that is the heart of science. Of course subsequently, as always happens in situations like this, we performed more experiments, wrote papers on our discovery, and so forth ... all important parts of scientific practice. But the core element was that cognitive act, that special moment of *aperçu*.

Several times in my professional work in laser-atomic physics or the experimental foundations of quantum optics, I've been privileged to enjoy fundamental and appreciative engagements with facets of our world. In each case, it was clear to me that in addition to filling out a description and advancing some physical theory in particular ways, I was also making contact of a sort that was akin to what happens in other domains, including the aesthetic, ethical and spiritual. These experiences have shed a light over my whole life. Insight into the phenomena, and appreciation of the connection to a full life—these were the concerns that Goethe held uppermost in his work on science. Not

just the models, but the aperçu, the discovery, the epiphanic dimension of knowing. Knowing as fundamental participation; not as a deduction or solution of an intellectual puzzle, but as a special kind of *seeing*.

It's worth mentioning here that the roots of our English language make a related point. In ancient Greek, the word "theory" means "to behold," to see. Goethe urged that we not lose this connection, but explicitly make it the heart of our approach. He gave his own treatment of the blueness of the sky and the crimson sunset along precisely these lines. And about such an approach to science, he says: (Goethe, 1995d)

"The ultimate goal would be: to grasp that everything in the realm of fact is already theory."

And:

"The blue of the heavens shows us the basic law of chromatics. Let us not seek for something behind the phenomena—they themselves are the theory."

Thus, his point is that we shouldn't seek to get past the phenomenon to some abstraction, or to a scientific metaphysics based on theoretically-reified abstract entities. Rather, we should intensify our engagement with the phenomenon, until the delicate empiricism is accomplished and we become directly appreciative of the phenomenon's essential features. This epiphanic form of "theory" might well prompt the development of abstract descriptions or models, and will probably use them in turn to help us further appreciate the phenomenon with increasing directness. But it shouldn't be confused with the models. It's something important in its own right, something more. And that "more" is vital both for doing science and for living well or living spiritually.

VI. Concluding Remarks

We began by concentrating on what has become familiar to us about science—the development of theoretical models. And while honoring that development, we also pointed out that the models' origin, in fact the origin and heart of all science, is actually located somewhere else—what Emerson called a poetic perception. A rigorous consideration of this notion should probably take account of Goethe's work on the nature of science, and his claims that true perceptiveness requires us to fully elicit and engage our world in all its aspects (its "effects"). We allow the world to work on us so that we may change and mature—we're cultivated by that engagement. And then we see the world anew.

That new seeing works back on us again—it's a cycle of becoming "concentric to Nature." The more we mature, the more we see. The more we see, the more we grow, and

know—in a complete sense. This is not just an active process, but a creative—even evolutionary—one.

Emerson says: (Pouncey, Peter 1991)

“We only see what we animate, and we animate what we see.”

Rather than emulating the camera obscura, the dark chamber, we must let the creative light of our minds engage and animate or *exercise* the world, illuminating it so that its nature becomes clear to us. Since this yields both good science and more developed human beings, we have become convinced that doing science properly is itself relevant to human maturation—and that it is related at its root to the other disciplines which emphasize a similar maturation. Each of them shares this connection to refined insight.

The practice of science might then include a process something like this: we “exercise” certain aspects of the natural, physical world through well-designed experiments. We collect and correlate data under a wide range of conditions, and gradually gain insight enabling us both to discern what we might call the real phenomenon at issue and to participate appreciatively in its workings. This understanding may in turn be formulated in hypotheses and theories, which can be tested and refined, and which further enhance our insight and sharpen our formulations. In this manner, we enter the world more fully and describe certain features of it more rigorously and perspicuously.

Our explorations of other domains of experience will not possess all the characteristics of scientific practice, such as an emphasis on formally stated theories. But they all involve an interplay between our participation in the world, insight regarding the adoption of an apt perspective, formulations in terms of concepts and ideas, and further (hopefully enriched) participation.

Along the way, we must take care not to abandon the insights for the formulations, not to reify the language and concepts, not to confuse the full engagement with the language. Often we can get so caught up in the formalism that we forget its motivating source. This is doubly regrettable because we then also lose our ability to see back *through* the formalism to the insightful engagement with the phenomena. Barfield might declare this lapse a kind of idolatry—the image has replaced the sacred dimension that it pictures. The models become idols, whereas they should be vehicles or aids to engagement with their true object.

A certain vigilance is required. We must note and avoid idolatrous tendencies, heeding above all the aperçu, the direct, epiphanic engagement. In this way, genuine knowledge is engendered. Preserving it in its true form and sharing it require both education and edification. The phrase “education as transformation” comes to mind. What else could it mean to truly educate? And we think this applies not only to others—children or young adults, but to ourselves as adults, on an on-going basis.

With an educated vision, it really is possible to work our way still further into the world, to stand on the hillside with Thoreau or Goethe, and become “true theory.” And we should have a confidence that if we do this carefully and responsibly, the domain of participatory experience will become increasingly nuanced, larger and more accessible. At first it may be confusing, like emerging from the cave that Plato described in the *Republic*. So we may not see much for a while, nor perhaps will we be able to make much sense of the world we do see. But gradually new appreciative capacities do arise, our insight will become sharper and its object more articulated. And then fully-dimensional knowledge becomes available within that new domain as well.

By always cycling between the formalisms and direct appreciation, engaging features of our existence at higher and higher levels, we not only respect experience and cede it a prominent place, but we reaffirm the value of the human being in the enterprise. With proper grounding, remaining concentric to Nature, our human capacities for insight become open-ended, free from any sharp boundaries. Our limits are simply the horizons of where we stand now, in our efforts to appreciate our life and world.

This is the common source for all human inquiry—for the artist, striving to see something new and challenging us to see as well; for the spiritual teacher, who can be helpful because he or she speaks from direct experience of the fundamental significance of our existence; for the conscientious scientist, valuing and encouraging an understanding of the theories as grounded in the world, rather than leaving us buried in a passive acceptance of the models. And in each case, with preparation, we can share the understanding and feel its authenticity. We can learn to work our way towards this source, and live from it. And depending upon our individual natures and aspirations, it will express itself in our various careers and actions, through our scientific research, artistic work, and spiritual practice.

Such a happy situation would be characteristic of what Goethe called a highly evolved Age, one that nurtures the maturation of awareness so it can embrace and function more within all the dimensions of our lives. In recent years, growing numbers of people from various sides of the real “knowledge project” have awakened to the challenge of implementing this unifying vision. Perhaps—as we so dearly hope—the spirit of that highly evolved Age is already with us now, and may continue to grow and flourish as never before.

In a sense science and spirituality are related because they’re both based on ontologically-relevant insights. They are both knowledge projects, both grounded in insights, but this is not the end of the similarity. They often draw on the *same type* of insight, deriving from aspects of the same ontology, one that isn’t broken into a “spiritual” part versus a “scientific” part. No such compartmentalization exists, at the root. The map depicting what is commonly supposed to be a sharp contrast between knowledge projects and more values-oriented concerns must be discarded. New maps of their relation must take account of substantial areas and kinds of overlap.

Based on a presentation Arthur Zajonc made at Salisbury College (March 8, 2000). Together with Steven Tainer, the paper was then supplemented and rewritten into the current version, which features our views on the subject of "insight."

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