

Michael Crichton's speech to the [CSICOP](#) at the end of Travels

I began by saying that I didn't expect to change anybody's point of view by what I was going to say. It wasn't my intention to convince anybody of anything, that night in Pasadena. I believed there was validity to certain psychic phenomena, and I knew most of my audience did not. Rather than dispute this in detail, I suggested we could all agree that history would eventually prove that either I was mistaken in my views, or they were mistaken in theirs. We could all confidently look forward to the eventual resolution of this issue.

Meanwhile, I wanted to tell this group some of the experiences that had led me to modify my own views, and to try and explain how things looked to me now. Because, I suggested, the real issue as I saw it went far beyond the relatively narrow question of "paranormal" phenomena. It went to the basic intellectual posture of science in the latter twentieth century.

I then said, Has anyone in this room had their tonsils and adenoids removed? Has anyone had a radical mastectomy for breast cancer? Has anyone been treated in an intensive care unit? Has anyone had coronary bypass surgery? Of course, many people had. I said, Then you're all knowledgeable about superstitions, because all these procedures are examples of superstitious behavior. They are procedures carried out without scientific evidence that they produce any benefit. This society spends billions of dollars a year on superstitious medicine, and that is a problem—and an expense—far more important than astrology columns in daily newspapers, which are so vigorously attacked by the brainpower of CSICOP.

And I added, Let's not be too quick to deny the power of superstition in our own lives. Which of us, having suffered a heart attack, would refuse to be treated in an intensive-care unit just because such units are of unproven value? We'd all take the ICU. We all do. I then went on to mention the many cases of fraud in research science. Isaac Newton may have fudged his data; 4 certainly Gregor Mendel, father of Mendelian inheritance, did.

5 The Italiano mathematician Lazzarini faked an experiment to determine the value of pi, and his result went unquestioned for more than half a century.

6 British psychologist Sir Cyril Burt invented not only his data, but research assistants to gather it.

7 In more recent years, there were cases of fraud involving William T. Summerlin of Sloan-Kettering, Dr. John Long of the Harvard Medical School, and Dr. John Darsee of the Harvard Medical School.

Other cases involved a research team at the Dana Farer Cancer Institute, Dr. Robert Slutsky of the UCSD Medical School, Dr. Jeffrey Borer of Cornell University, Stephen Breuning of the University of Pittsburgh. Though most cases had come from medicine and biology, there were examples in other fields as well; three papers in the Journal of the American Chemical Society were recently retracted, in a case still under investigation. The extent of fraud was unknown, but I reminded the group that fraud undeniably exists in science. Thus the fact that there are some fraudulent practitioners in a field cannot be an argument to dismiss that whole field of inquiry. Next I reminded them that science as a field does not progress in a uniquely rational manner different from other fields of human endeavor, such as business or commerce. Max Planck, who won the Nobel Prize in physics, said, "A new scientific truth does not triumph by convincing its

opponents and making them see the light, but rather because its opponents eventually die, and a new generation grows up that is familiar with it.”

I reminded them of the tendency of scientists in every age to think that they finally know it all. For example, the French anatomist Baron Georges Cuvier, one of the most brilliant and influential scientists of his day, announced in 1812 that “there is little hope of discovering new species of large quadrupeds.” Unfortunately for Cuvier, this statement preceded the discovery of the Kodiak bear, the mountain gorilla, the okapi, the white-backed tapir, the Komodo dragon, Grant’s gazelle, Grevy’s zebra, the pygmy hippopotamus, and the giant panda, to name just a few large quadrupeds. Similar claims of nearly complete knowledge have been made by physicists in almost every generation; such claims have been invariably proven wrong.

I reminded them of the past failures of science to accept legitimate discoveries at the time they were made. When J. J. Thomson measured the mass and charge of the electron in 1899, many of his colleagues suspected him of fraud—or ineptitude, since he was famously clumsy around any experimental apparatus.

8 When Carl Anderson of Cal Tech discovered the positron in 1932, both Bohr and Rutherford dismissed the new finding “out of hand.”

9 And the theory of continental drift, proposed by Alfred Wegener in 1922, should have been obvious to anyone who looked at a map of the world and saw how the continents could be fitted together, yet it took forty years for geologists to overcome the opposition of such eminent men as Harold Jeffreys and Maurice Ewing to this theory. I reminded them that the rate of progress in science was highly variable. Newton’s theory of gravitation stood unchallenged for more than two hundred years before the precession of the planet Mercury was found to disprove it.

10 And, conversely, hypnotism was a discredited practice for more than two hundred years, ever since a blue-ribbon panel of scientists in Paris, including Benjamin Franklin and Lavoisier, had pronounced mesmerism without merit; yet today hypnosis is unquestionably genuine and widely practiced. Thus the rate of progress within a field is no indicator of the validity of the field. Next I pointed out the trends and fads of science, which affected scientists at every level. It was perfectly acceptable for dozens of the world’s most distinguished scientists to propose that our society engage in a costly search for extraterrestrial life,

11 despite the fact that the study of extraterrestrial life is, in the words of the paleontologist George Gaylord Simpson, “a study without a subject.”

12 A belief in extraterrestrial life is a speculation indistinguishable from pure faith. Few if any of those great scientists would sign their names to a proposed study of psychic phenomena, because the paranormal is not fashionable in the way extraterrestrials are. Yet there is arguably more evidence for psychic phenomena than there is for extraterrestrials. So I was saying that, from where I stood, the enterprise of science did not look so different from other human enterprises. There was institutionalized superstition; there was fraud; there were missteps and errors; there was conservatism and plain pigheadedness; and there were fashionable trends. Observed Marcello Truzzi, a former editor of the CSICOP journal, “Scientists are not the paragons of rationality, objectivity, open-mindedness and humility that many of them might like others to believe.”

13 I was reminding the audience of this, not to discredit science, but to place the workings of science in a more realistic perspective with regard to unaccepted phenomena. Next I said I wanted to address one of the most difficult stumbling blocks in the scientific approach to disputed phenomena.

In many cases, such as so-called psychic activity, researchers came up against the argument by so-called practitioners that they couldn't reliably produce results on demand; that they couldn't work in a laboratory setting; that they were inhibited by the frowning skeptics around them; and so on. It seemed that the practitioners were defining a state-dependent phenomenon. Practitioners had to be "in the mood," and the mood was easily shaken.

Traditionally, scientists found this position hard to accept. Mystical states, meditative states, trance states, were all hard for scientists to accept. Yet everyone has firsthand knowledge of activities for which you must be "in the mood": for example, sexual intercourse, requiring lubrication in the female, erection in the male. Creative work is another state-dependent activity that cannot be reliably performed on demand, as the vast literature devoted to "courting the muse" testifies. We know from subjective reports and from our own experience that these state-dependent phenomena are accompanied by a change in consciousness.

There may be a perceived or a real change in energy and concentration; there may be a change in perception of time, and so on. Such changes vary from day to day, from person to person, and from experience to experience within the same person. The highly variable nature of the experiences, and the subjectivity of the experience, make state-dependent phenomena a difficult challenge to scientific investigation. I would suggest to you that the scientific study of creativity has fared no better in the last century than the scientific study of psychic activity, and for much the same reasons. Yet nobody would deny that creativity exists. It is merely very hard to study.

Skeptical scientists often point out, as Carl Sagan has, that the wonders of real science far surpass the supposed wonders of fringe science. I think it is possible to invert that idea, and to say that the wonders of real consciousness far surpass what conventional science admits can exist. For example, suppose I told you that, while a group of huge men charges at you with the intention to maim you, you were required to throw a ball seventy meters to strike a one-meter target that you can't see just before you are slammed to the ground and crushed to a pulp. I doubt there is a single person in this room who could do such a thing, or would even dare attempt it. Yet we can observe this unlikely event performed every Sunday afternoon on television, during football season. The change in consciousness necessary to execute a downfield pass in a professional football game is ordinary to us and hence unremarkable, but it at least suggests that other trained changes in consciousness, arising from other cultures and traditions, may also yield surprising results. I earlier attempted to cover, in an informal way, some of the scientific objections to so-called paranormal phenomena. It is true that many of these beliefs are superstitions, but so are many beliefs in the more scientific world, such as the world of high-tech medicine.

It is true that many practitioners are frauds, but a proportion of working scientists are also frauds. It is true that progress in the paranormal investigation is slow, but so is progress in many scientific fields, particularly when they are poorly funded. It is true that some paranormal phenomena seem to be state-dependent and consciousness-related, but so are many everyday phenomena that lead to such unremarked wonders as a new painting, or a Sunday touchdown pass. Thus, to my mind, none of these traditional scientific complaints about the paranormal seems adequate to dismiss the field from legitimate study. In looking at the matter more closely, I find three other reasons that are much more powerful grounds for dismissal. The first is the

quasi-religious discomfort these phenomena evoke in a hard scientist. In the early years of this century, Freud and Jung ended their close friendship over the issue of occult phenomena:

14 Jung was openly interested in the paranormal;

15 Freud was not. Before the split, Freud wrote Jung: "My dear son, keep a cool head, for it is better not to understand something than make such great sacrifices to understanding."

16 And Jung's enthusiastic interest in astrology, which he studied as a system of psychological projection and not as a physical reality, caused Freud to reply, "I promise to believe anything that can be made to look reasonable. I shall not do so gladly...."

17 The question is, why not? What was Freud's reluctance? Freud himself studied mythology and art without hesitation. But the occult made him uncomfortable in a way that is recognizable yet difficult to identify precisely. One can argue that the discomfort has fundamentally religious origins—origins so deep as to be untraceable except through lengthy argument, which is not relevant here. In addition, paranormal phenomena provoke a related discomfort, which has at its core an intellectual prejudice. I would venture to say that nearly everyone here tonight has an advanced degree. We have all survived a great deal of schooling, and we are skilled in rational, linear thought. We have been trained to value such thought and the products of such thought.

Thus we turn with palpable uneasiness to the occult section of the bookstore, which contains writing by all sorts of illiterate and uneducated people. These people don't share our thought systems or our sentence structures, and we are likely to see ourselves as slumming when we consider their work. Whether we admit it or not; any person of academic standing holds certain criteria that govern the kinds of references he will cite in his writing, and for that matter the kind of subjects he will write about in the first place. I suggest that these criteria represent a powerful prejudice that has colored all formal academic consideration of the paranormal—as the unsavory reputation of Mesmer colored the assessment of his claims for hypnotism. A third reason scientists are reluctant to examine paranormal phenomena is that they appear to contradict known physical laws. What is the point of studying the impossible? Only a fool would waste his time. The problem of data in conflict with existing theory cannot be overstated. Arthur Eddington once said you should never believe any experiment until it has been confirmed by theory, but this humorous view has a reality that cannot be discounted. Indeed, the primacy of theory is conveyed by scientific history.

Bronowski notes: "Charles Darwin did not invent the theory of evolution: that was known to his grandfather. What he thought of was a machinery for evolution: the mechanism of natural selection.... Once Darwin had proposed this [mechanism], the theory of evolution was accepted by every one; and it was thought the most natural thing in the world to call it Darwin's theory."

18 In other words, data to support the idea of evolution—such as the fossil record—were long known; but a convincing theory to explain the data was lacking. Once Darwin provided the theory, the data were accepted. Now consider so-called psychic phenomena, such as clairvoyance, remote-viewing, and psychokinesis. On the face of it, all these phenomena seem to be contradicted by physical theory. At least, there is no immediately available theory to account for them. And that, it seems to me, is a major reason why data to support these phenomena are denied. What data? you may ask. Many scientists deny there are any data at all—that there is no incident or event that is properly documented, properly controlled, and therefore not

subject to fraud and trickery. Yet there are, in fact, well-studied subjects who appear to defy scientific explanation—in particular the famous medium of the last century, Mrs. Piper, who was championed by William James, professor of psychology at Harvard. Mrs. Piper was subjected to intense scrutiny for nearly a quarter of a century, but no skeptic was ever able to demonstrate fraud or trickery. Yet the claims of fraud persisted. James wrote rather irritably, “The ‘scientist’ who is confident of ‘fraud’ here, must remember that in science as much as in common life an hypothesis must receive some positive specification and determination before it can be profitably discussed; and a fraud which is no assigned kind of fraud, but simply ‘fraud’ at large, fraud in abstracto, can hardly be regarded as a specially scientific explanation of specific concrete facts.”

19 As for other scientists who continued to claim as-yet undetected fraud, James retorted, “I believe there is no source of deception in the investigation of nature which can compare with a fixed belief that certain kinds of phenomena are impossible.”

20 Beyond the narrower question of whether an isolated phenomenon, such as clairvoyance or telepathy or seeing auras, actually occurs, there is a broader issue affecting science in the modern day. I refer to a certain fixity of viewpoint among scientists, a certain tendency to confuse contemporary scientific theories with the underlying reality itself. Jacob Bronowski, one of the most eloquent commentators on the relationship of science to other human activities, always reminded us that scientific theories are a fiction. “Science, like art, is not a copy of nature but a re-creation of her.”

21 Science offers a picture of the world, but its picture is not to be confused with the underlying reality itself. Yet we all tend to confuse our fictional views with reality. I think most of us have glanced out of an airplane window while crossing the United States, and have been surprised not to see lines dividing the states, as those lines appear on a map. I myself remember the shock I felt when I first looked at live human tissue under a microscope, and found it colorless; I expected to see pink cells with purple nuclei. Yet those colors are artifacts that come from microscopic stains. Real cells have no color. Of course I knew better, just as we all know there are no lines on the land to demarcate the states. But we forget. And, in fact, we forget with a surprising ease. I was educated in a twentieth-century, Western, scientific-rational tradition. I was raised to think that the scientific view of the world was the correct view, and that every other view was pure superstition.

I agreed with Bertrand Russell when he said, “What science cannot tell us mankind cannot know.” I had few formal experiences to contradict this view. But my later experiences have broken out of that scientific-rational perspective. I still find the scientific view useful, and I live happily within it much of the time. But I now regard science as providing an arbitrary and limited model of reality. Because reality is always greater—much greater—than what we know, than whatever we can say about it. Let’s review why, with a simple thought experiment. * * * Think of a person you know well. Now make any correct descriptive statement about that person. George is an even-tempered man. Now consider that statement. Is it really correct? The chances are, as you consider it, you’ll begin to remember times when George lost his temper, or was upset about something, or in a bad mood for some reason. You’ll think of the exceptions. So you must admit the statement is not quite accurate. You could modify it to say, George is often an even-tempered man, but that is actually just evasive. That word “often” merely says the statement is sometimes correct but sometimes not. And since it doesn’t tell when the statement is not correct, it isn’t very helpful. So you’d have to be more explicit, to give a fuller statement. George is usually an even-tempered man, except on Mondays when his favorite football team lost the day before, or when his wife had a fight with him, or when he gets tired and

cranky—usually late in the week—but not always—or when his boss gives him a hard time, or when he has to rewrite a report, or when he has to go out of town ... or when ... or when ... Pretty soon you see that your descriptive statement is turning into an essay. And you still haven't covered all the things you know. It's still not complete.

You could write pages and pages and you would still not be finished. In fact, it's hopeless to try to make a complete statement about George's ever-changing temper. The subject is too complicated. It was doomed from the start. So let's start all over. Let's make a different statement. George is neat and orderly. That's unquestionably true, you think. George is always neatly dressed, and his desk is always tidy. But have you ever seen the workbench in his garage at home? What a mess! Tools scattered all around. His wife is always after him to clean it up. And what about the trunk of his car? All kinds of junk in there that he never bothers to clean out. George is usually neat and orderly. But by now you can see where this modification is eventually going to end up—in another essay. So let's make a different statement, one that is both concise and complete. George has gray hair. That does it, you think. He has gray hair and there's no question about it. Of course, not all of his hair is gray. Most of it is, though, especially around the temples and the back of the neck. So there's some simplification here, but it's not objectionable. Then, too, even if George has gray hair now, he didn't a few years ago. And at some time in the future, he will no longer have gray hair, he will have white hair. So this is only a correct description of George's hair right now, at this moment in time. It isn't a description of George in some universal, invariant way. Let's try again. George is six feet tall. Again, true, within the limits of measurement. He's probably not exactly six feet. He's probably somewhere between five eleven and six one. And of course he wasn't always six feet. At an earlier time he was much shorter. So this statement is only approximate, too. George is a man. Well, yes. But "man" is rather unspecific; it's really a culturally determined word, when you get right down to it. At birth he was not considered a man. You have to attain a certain age and position in society to be considered a man. George is a male. Now, that's unarguable. George is, and always was, a male. There's no way to dispute that. It is a true statement about George, both now and in the past. It is an eternal verity. It is an accurate description of the reality of George. Of course, by "male" we mean that he has an X and a Y chromosome. But we don't know that for sure, do we? George might have an extra chromosome. He might only be apparently male.... And so on.

There are two points about this exercise in making statements about George. The first is that every single statement we make about George can be contradicted. Why is that? It's because our statements about George are only approximations, simplifications. The real person we call George is always more complicated than any statement we have made about him. Thus we can always refer to that real person and find in him a contradiction to what we have said. The second point is that the statements about George that are most securely held are also the least interesting. We can't say anything comprehensive about his moods or his neatness or his complex behavior. We are on much safer ground describing the simplest aspects of his physical appearance: hair color, height, sex, and so on. There—with some qualifications of measurement error and changes over time—we can be sure of what we are saying. But only a tailor would take pride in this fact. And, indeed, a tailor might. After making many fittings for George, and adjusting the patterns at each fitting, the tailor might eventually be able to cut a suit of clothes for George entirely in his absence, and when George came in for a final fitting the finished clothes would fit him perfectly! This is a triumph of the art of measurement, but the clothes that fit so wonderfully are draped over a creature whom the tailor may not know at all. Nor is the tailor interested. He couldn't care less about other aspects of George. It's not his job. On the other hand, what interests us most about George is not his measurements. We are most interested in precisely those other aspects, which the tailor, by definition, doesn't care about. We find it far more difficult to define those other aspects of George than the tailor does to define George's measurements. The tailor can

do his job of description perfectly. We, on the other hand, can't really describe George at all. Now, since the tailor is so good—so clearly successful—at what he does, we might be tempted to ask the tailor, "Who is George?" The tailor will answer, "George is a forty-four long." And if we protest that this answer isn't really satisfactory, the tailor will reply with assurance that he is unquestionably right about George, because he can cut a whole suit of clothes that will fit George perfectly the moment he walks in the door.

This, in essence, is the problem with the scientific view of reality. Science is a kind of glorified tailoring enterprise, a method for taking measurements that describe something—reality—that may not be understood at all. Science is very good as far as it goes. It has certainly produced powerful benefits. It would be crazy to abandon science, or to deny its validity. But it would be equally crazy to think that reality is a forty-four long. Yet it seems as if that is what Western society has done. For hundreds of years, science has been so successful that the tailor has taken over our society. His knowledge seems so much more precise and powerful than the knowledge offered by other disciplines, such as history or psychology or art. But in the end one can be left with a nagging sense of emptiness about the creations of science. One may even suspect that there is more to reality than measurements will ever reveal. Let's return to the earlier problem: describing a person named George. When we looked at anything except his physical measurements, we found that it was extremely difficult to make any statement about George that could not be immediately contradicted by other statements, equally true. Now, we might struggle with this problem for a while longer, and keep searching for incontrovertible statements about George. But eventually, after repeated failures, we may begin to suspect that there is no way we can succeed at this undertaking. The reality of George keeps slipping away from us. Whatever we say is wrong.

At that point someone who says, "Existence is beyond the power of words to define," may not sound so esoteric. This seems to be exactly what we have discovered on our own. However, this statement was made by Lao-tzu, a Chinese mystic, twenty-five centuries ago. Lao-tzu was adamant on this point, repeating it again and again: "Existence is infinite, not to be defined." But if that is the case—if reality will always elude our definitions, just as George does—what can we do?

There is no need to run outside For better seeing, Nor to peer from a window. Rather abide At the center of your being; For the more you leave it, the less you learn. Lao-tzu argues that it is necessary to turn inward, toward an inner sense of reality, instead of looking outward. This would appear to be a criticism of academic undertakings, and indeed he is elsewhere explicit: Leave off fine learning! End the nuisance Of saying yes to this and perhaps to that, Distinctions with how little significance! Categorical this, categorical that, What slightest use are they!

Lao-tzu makes many similar statements, which seem to be opposed to scholarly learning, even to knowledge. Why does he think this way? People through finding something beautiful Think something else unbeautiful, Through finding one man fit Judge another unfit. Life and death, though stemming from each other, Seem to conflict as stages of change, Difficult and easy as phases of achievement, Long and short as measures of contrast, High and low as degrees of relation; But since the varying of tones gives music to a voice And what is is the was of what shall be, The sanest man Sets up no deed, Lays down no law, Takes everything that happens as it comes.... He is really saying, Don't make distinctions, because every distinction simultaneously defines its opposite, and in many cases the interplay of opposites is indivisible, just as varying tones make up music. He says, If you approach the world through distinctions, you can never untangle your perceptions. The surest test if a man be sane Is if he accepts life whole, as it is, Without needing by measure or touch to understand The measureless untouchable source Of its images.... The attitude of Lao-tzu

represents one way to deal with the fact that whatever we say about reality is inevitably wrong or incomplete. Lao-tzu says you must “accept life whole, as it is, without needing ... to understand.”

This attitude is in a sense antirational, and certainly anti-intellectual. But it is another perspective, clear and consistent. Although it may not be to everyone's taste, we are obliged to acknowledge that it is a genuine solution to a genuine problem. * * * In his day Jacob Bronowski was at some pains to address a predominantly humanistic audience, persuading them to pay attention to science by drawing connections between humanistic pursuits and scientific pursuits. Thirty years later the balance has shifted to the other side. Now it seems to me it is the scientists who need to be reminded of the similarities between their activities and those of other men, and in particular to be reminded that the rational, scientific, reductionist method is not the only route to useful truth. I find this the most striking prejudice among the scientists I know. My friend Marvin Minsky, in a recent book, writes about mystical states in a highly critical way. He finds these states “sinister” and speaks of the “victims of these incidents.” His view is expressed thus: “One can acquire certainty only by amputating inquiry.... To offer hospitality to paradox is like leaning toward a precipice. You can find out what it is like by falling in, but you may not be able to fall out again. Once contradiction finds a home, few minds can spurn the sense-destroying force of slogans such as ‘all is one.’ ”

22 Even more bluntly, Stephen Hawking says that mysticism “is a cop-out. If you find theoretical physics and mathematics too hard, you turn to mysticism.”

23 Such statements, broadly speaking, agree with Asimov's comment that intuition is for those who have “lost their nerve.” Hawking takes the idea further, implying that mysticism is a procedure for those who aren't bright enough to do physics. I disagree with this attitude. Perhaps the easiest way to state my objection is to say that I do not find the content of physics sufficient to explain the behavior of physicists' themselves. Where does the physicists' belief in consistency, in unification, come from? This belief is so strong that men and women devote their lives to proving its existence. Yet it is nothing visible in the world. What we see before us is a world of apparently disunified objects and events. The underlying unity is something we seek and find.

Granted that the scientific perception of unity is not the same as the mystic's perception of unity, there is still a question: what provokes a scientist to look for unity at all? Is it just a matter of tidying up the mathematics? Does any thoughtful scientist seriously believe that purely formalistic concerns are sufficient to make him work long hours, year after year? Is science such a totally self-referential system that making inner connections between theories is the only driving force? I think not. I suspect that scientists are driven by the sense that the world out there—reality—contains a hidden order, and the scientist is trying to elucidate the hidden order in reality. And that impulse is what the scientist shares with the mystic. The impulse to get to the bottom of things. To know how the world really works. To know the nature of reality.

A Nobel Prize-winning physicist wrote: I wanted very much to learn to draw, for a reason that I kept to myself: I wanted to convey an emotion I have about the beauty of the world. It's difficult to describe because it's an emotion. It's analogous to the feeling one has in religion that has to do with a god that controls everything in the whole universe: there's a generality aspect that you feel when you think how things that appear so different and behave so differently are all run “behind the scenes” by the same organization, the same physical laws. It's an appreciation of the mathematical beauty of nature, of how she works inside: a realization that the phenomena we see result from the complexity of the inner workings between atoms; a feeling of how dramatic and wonderful it is. It's a feeling of awe—of scientific awe—which I felt could be

communicated through a drawing to someone who had also had this emotion. It could remind him, for a moment, of this feeling about the glories of the universe.

24 Some of you may recognize the writer as Richard Feynman, a distinguished member of the Cal Tech faculty. I cite the passage because it appears, in broad strokes, to express exactly the kind of unified insight that other scientists denigrate. And also because, from this most confident and unpedantic of authors, the statement is heavily qualified: Feynman says his feeling is “analogous to the feeling one has in religion.” It’s an appreciation only of the mathematical beauty of nature. And the awe is expressly scientific awe, as if scientific awe were somehow different from regular awe. This strikes me as an oddly cautious expression of what is, I suspect, a nearly universal human emotion. And while we are talking about Feynman’s artistic career, it’s worth mentioning one of the discoveries he later made. Sometime after he began drawing, he visited the Sistine Chapel. He had left behind his guidebook, so he just went around looking at the paintings. He found some of the paintings to be very good, and others to be, in his word, “junk.” Back in his hotel room, he found that his judgment of the paintings agreed with the guidebook.

This was a terrific excitement to me, that I also could tell the difference between a beautiful work of art and one that’s not, without being able to define it. As a scientist you always think you know what you’re doing, so you tend to distrust the artist who says, “It’s great,” or “It’s no good,” and then is not able to explain to you why.... But here I was, sunk: I could do it, too!

25 Why does he say he was sunk? What, exactly, is sunk? Throughout his memoir, Feynman rather breezily dismisses most fields of activity other than physics. He is a man of mathematical rigor, so he finds little of interest in philosophy or art or psychology. These fields make no sense to him; the practitioners “don’t know what they are talking about.” Yet in the Sistine Chapel he has experienced something that sinks his conception of these other fields. Simply by doing art himself, he has acquired the ability to make perceptions about other art that agree with the formal and codified perceptions of art history. Feynman does not discuss this remarkable incident further, although there is clearly more to be said. For one thing, his experience would seem to imply that, although he does not try to bring his critical criteria to conscious awareness, the criteria nonetheless exist. They must exist, or else he would never manage to agree with the guidebook. Second, the criteria are not arbitrary or academic, since Feynman is able to formulate those criteria simply by the experience of making pictures. The criteria of art history do indeed have something to do with the activity of making art. There is an underlying rigor to art history, which Feynman has demonstrated by reproducing its conclusions. I am discussing this at length because it seems to me that it typifies a situation in which a tremendously bright scientist, confronted by data, even admitting the data, nevertheless does not take those data to the obvious conclusion: that there is just as much rigor to art as there is to science. It may be a different kind of rigor, but it is rigor nonetheless. When an artist such as Jasper Johns says, “I am just trying to find a way to make pictures,”

26 he means it in exactly the same way a physicist means it when he says, “I am just trying to find a way to do physics.” Like a scientist, an artist must build upon the work of his predecessors. An artist can be intimidated by the work of his predecessors, just as a scientist can be. So for a scientist to dismiss art as some kind of formless activity in which “anything goes” means only that the scientist doesn’t understand the activity of making art. He doesn’t understand what he is dismissing. The scientist has only his model of what the activity of art is, and his model is wrong. It’s uninformed; and it doesn’t fit the data. The extent to which scientists are uninformed about the real work of nonscientists seems to me to reach some ultimate point when scientists consider meditative states, alterations in consciousness, and the disputed psychic

phenomena. If you have never experienced these things firsthand, you will naturally find the descriptions of them to be outlandish. Because these experiences are different from the experiences of ordinary consciousness. There is no great mystery here, and certainly nothing sinister. It's just different. It's another kind of consciousness.

I have known in my life one computational prodigy, and, watching him, I could not conceive how he was able to do what he did; I was simply obliged, after checking a few times, to accept that he could do it. I know one film director with a photographic memory, but he's rather tedious, given to impromptu lectures in exhaustive detail on all sorts of subjects. All that I learned is that I should never argue with him about an obscure fact, since he was invariably correct. But I couldn't conceive how he could do what he did, either. I have a rather similar feeling around people with psychic abilities. They can do something I can't do. To them the ability is mundane, and on balance has its good and bad features. I often hear skeptics say that, if psychic behavior was real, the psychics would be playing the stock market or the ponies. In my experience, many of them do. There is, in fact, a kind of secret level of activity in which psychics consult to major corporations and businesses. People seem to be embarrassed to admit this activity, but it takes place, just as you'd expect it to. And I would remind you that, from one standpoint, you might expect so-called psychic behavior to exist in the first place.

The eminently sensible Dr. Bronowski again: In science ... the process of prediction is conscious and rational. Even in human beings this is not the only kind of prediction. Men have sound intuitions which have certainly not been analyzed into rational steps, and some of which may never be. It may be for example, as is sometimes claimed, that most people are a little better at guessing an unseen card, and some people much better, than would be a machine which merely picks its answers by chance. This would not be altogether surprising.... Certainly evolution has selected us rapidly because we do possess gifts of foresight much above those of other animals.... The rational intelligence is one such gift, and is at bottom as remarkable and as unexplained. And where rational intelligence turns to the future, and makes inferences from past experiences to an unknown tomorrow, its process is ... a great mystery....

27 But to return to the original point, the experience of these other forms of consciousness seems to me to be ordinary, even mundane. These different forms of consciousness—whether inborn gifts or trained procedures—lead to other kinds of knowing, other perceptions of underlying order in the world around us. They are not mathematical perceptions, but they are perceptions nonetheless. Before you dismiss these perceptions outright as fraud or fantasy, it seems useful to experience them firsthand. If you're not willing to experience them firsthand, you open yourself to the criticism that you dismiss what you don't understand. And you diminish your own experience of reality. Because, as I have said, the scientific perception of reality is not reality itself. Even the most powerful scientific law is not a complete description of reality. There is always more to know. I think it's important to be very clear about this. Feynman, whom I much admire, says of nonscientific people, "they don't understand the world they live in." It seems to be a favorite saying of his; he repeated it often during the shuttle-disaster investigations. But let's be clear: nobody understands the world he lives in. Not you, not me, not Richard Feynman. We may each understand a part, an aspect of the whole, but, in any full or comprehensive sense, reality defies description. And if other modes of knowing are internal, subjective, and inherently unverifiable, that doesn't make them necessarily any less interesting or useful.

People who find numbers alien to their natures are not fringe people in the world, the disenfranchised, the despised ignorant who do not know how to solve differential equations and so are denied access to

mathematical received truth. Because science alone is not enough. Faced with a public that embraces creationism and belief in psychic phenomena, the hard scientist is often perplexed. The scientist sees a world of beauty and complexity, entirely challenging enough for his rational approach. Why, he wonders, is someone else dissatisfied with his vision of the world? Why is science not enough? The simplest answer is that, while science is a tremendously powerful investigative procedure, it doesn't tell us what we really want to know. Max Planck put it simply: "Whence come I and whither go I? That is the great unfathomable question, the same for every one of us. Science has no answer to it." One reason is that science can't tell you why anything happens. Feynman again, in a popular lecture on quantum electrodynamics: "While I am describing to you how Nature works, you won't understand why Nature works that way. But you see, nobody understands that. I can't explain why Nature behaves in this peculiar way."

28 This is true, but it evades the fact that, although knowledge of how things work is sufficient to allow manipulation of nature, what human beings really want to know is why things work. Children don't ask how the sky is blue. They ask why the sky is blue. Feynman would probably say that question has no meaning. And within the body of modern scientific thought, it does not. But it is not self-evident that this state of affairs will continue indefinitely. Physicist John Bell notes: The founding fathers of quantum mechanics rather prided themselves on giving up the idea of explanation. They were very proud that they dealt only with phenomena: they refused to look behind the phenomena, regarding that as the price one had to pay for coming to terms with nature. And it is a fact of history that the people who took that agnostic attitude towards the real world on the microphysical level were very successful. At the time it was a good thing to do. But I don't believe it will be so indefinitely.

29 But, in the meantime, a mathematician observes that "the question of why is hardly touched by physical scientists, all the emphasis being placed on how.... The metaphysics of the cosmos is given in terms of abstract mathematics which is claimed to be absolutely devoid of goals or purposes: the reality of contemporary cosmology is a mathematical reality."

30 Yet this mathematical reality is essentially arbitrary.

31 And this perception of a purposeless universe is not attained without cost. Modern science holds up its mathematical model as a triumph of reason, yet, as Hannah Arendt notes, "Modern times, dominated by technology, are characterized precisely by the fact that reason, in the sense of an originally given self-revealing contemplative understanding, is lost, and is replaced by a detached [technology], actively preoccupied with abstract mathematical theory and physical replication."

32 To me there is nothing wrong with a mathematical perception of reality as long as that perception is not allowed to predominate. Because, as human beings, living our lives, making decisions for ourselves and our society, we must find meaning. And that meaning must be broadly based. A mathematician: I am aware of the ingredients out of which meaning is created ... love and language, myth, rational thought and irrational impulse, human institutions, law, history, duty, ritual, religious faith, the mystic, the transcendental, the allegorical, the aesthetic sense, play, the world as a puzzle, the world as a stage, the contemplation of life and death, the necessities imposed by physics and biology; all of these and hundreds more are avenues to meaning.

33 This may be why Einstein once said, "Humanity has every reason to place the proclaimers of high moral standards and values above the discoverers of objective truth. What humanity owes to personalities like

Buddha, Moses, and Jesus ranks for me higher than all the achievements of the enquiring and constructive mind.” The fact is that we need the insights of the mystic every bit as much as we need the insights of the scientist. Mankind is diminished when either is missing. Carl Jung said: The nature of the psyche reaches into obscurities far beyond the scope of our understanding.

It contains as many riddles as the universe with its galactic systems, before whose majestic configurations only a mind lacking in imagination can fail to admit its own insufficiency.... If, therefore, from the needs of his own heart, or in accordance with the ancient lessons of human wisdom, or out of respect for the psychological fact that “telepathic” perceptions occur, anyone should draw the conclusion that the psyche, in its deepest reaches, participates in a form of existence beyond time and space ... then critical reason could counter with no other argument than the “non liquet” of science.

Furthermore, he would have the inestimable advantage of conforming to a bias of the human psyche which has existed from time immemorial and is universal. Anyone who does not draw this conclusion, whether from skepticism ... lack of courage or inadequate psychological experience or thoughtless ignorance ... has instead the indubitable certainty of coming into conflict with the truths of his blood....

Deviation from the truths of the blood begets neurotic restlessness....

Restlessness begets meaninglessness, and the lack of meaning in life is a soul-sickness whose full extent and full import our age has not yet begun to comprehend.