vation, damnation, and what not, and still "miss the point": for medieval minds this *was* reality, and it was a reality that was unyielding. As a work of art and as a description of reality, we cannot fully absorb "the point" here, if indeed the modern mind can absorb it in more than a superficial way at all, in any other than a nonrational and experimental manner. Can we really see this work as a profound expression of another reality by simply, rationally, and mechanically, reciting to ourselves a list of all the details that contribute to it? Assuredly not. Now, of course, we can make such rational ponderings before and after we have had our moment of insight into this other world, but it does not appear that we can have that very insight except in a nonrational way. And an experimental, trial-and-error method for reaching such a nonrational insight seems to be the method we most often employ toward this end.

A few comments on the subject of classical music generally and piano music in particular may shed more light. This latter subject is one I have been familiar with for a long time. Speaking from singular, personal experience in such matters is of course highly risky if generalizable principles are sought, but perhaps one or two personal observations will not hinder our inquiry. I can clearly recall a handful of occasions when, as a concert player, all the aspects involved in a performance "clicked" into place. All the preparations, hundreds of hours of practicing, rehearsals, deciphering of musical scores, and so forth, seemed to have been but an enormous rational, but mostly "hidden," prologue to a sustained moment of nonrational, artistic enlightenment. My belief that these occasions were not merely moments of subjective self-delusion or indulgence was bolstered by the fact that audiences seemed likewise to have been "inspired." Audiences know, after all, when a performer is insincere, when there seems to be a contradiction between what the performer is actually doing and what he or she is presumably attempting; and they know this, at least in part, at a nonrational level.

The best general description I have been able to muster for these moments and occasions when everything seemed to fall into place is that they form an imprecise combination of the religious, the emotional, and the artistic. More precisely and prosaically, these moments seem similar to descriptions offered by athletes of particularly successful efforts in sports activities. In the cases of both the artist and the athlete, three phenomena are often associated with profound experiences: (1) a seeming suspension of the orderly passage of time, (2) a kind of effortless precision in execution, and (3) fierce but somehow relaxed mental concentration that produces an almost objective detachment from the activity itself. One seems, at one and the same time, to be a deeply involved participant and yet also a detached, almost neutral, observer. No reasoning whatsoever seems involved at such moments, and no recipe or mechanically executed routine will produce this end. The subject of music is, thus, an elusive one to examine for these purposes.

So it seems indeed to be the case in some religious, emotional, and artistic matters that nonrational insight, gained through a kind of experimentation rather than attempted through a kind of rote, mechanistic routine, has a redoubtable role to play in our acquisition and development of knowledge. But there are, of course, limits to the scope of nonrational insight. We would find it quite unsettling, for instance, should a judge and jury pronounce a verdict, a medical organization decide about an organ transplant, the Internal Revenue Service ponder a lien on our property, or a university professor record a semester's grade based solely on a supposed nonrational insight. No one would or should, for example, accept a failing grade in a course when the professor in charge claims the following as the rationale: "Well, I had a really intense nonrational insight into all of this business about your grade for the term, and so I have decided that you are going to get an F in this course because (a) God spoke to me and told me that this is the grade you should receive, or (b) emotionally I detest you, so I will psychologically erode you with this grade, or (c) your physical presence is aesthetically repulsive to me, so I will drive you away with this grade. The grades you may have actually earned during this course are completely irrelevant in the matter."

This would be a most unsatisfactory state of affairs because the decision here has been a *subjective* one rather than an *objective* one. What is the difference? Roughly put, a conclusion based on subjective considerations is usually little more than a matter of purely personal opinion, while a conclusion based on objective considerations is one drawn in comparison to matters that are, to some degree at least, *independent* of personal opinion. The affair concerning the grade is of course a subjective matter, one that asserts a contradiction between recorded performance and the final grade that supposedly reflects such performance. In contrast, the conclusion that water, under certain identifiable and repeatable conditions, boils at 212 degrees Fahrenheit is based on the occurrence of a phenomenon whose occurrence itself is completely independent of what we may think of it. As indispensable as creative, experimental exercises of nonrational insight are for the acquisition and development of our knowledge, however, they themselves, being at the moment of their very occurrence independent of our reasoning processes, cannot be rationally justified in that moment. That is, how could we nonrationally challenge our professor friend in such as way as to demonstrate, objectively and unequivocally, that his supposedly nonrational religious, emotional, and aesthetical insights were just plain wrong?

The problem, of course, is that we cannot construct such a *challenge*, precisely considered, on solely nonrational grounds, and we are prevented from doing so because, given the nature of nonrational insight, the best we can hope for is but a different expression of subjectivism, a contradictory expression of the same fundamental problem. In principle, this sort of seemingly irresolvable conflict must have been on the mind of the pianist Artur Schnabel (1882–1951) when he commented that "the classification of right or wrong [has no] validity for music, which is beyond being measured and judged by quantity or by 'moral' standards" (Schnabel 1942: 16). A nonrational insight in and of itself is not capable of rational criticism. But its practical effects, both observable and conceivable, *are* subject and must be subjected to rational criticism if a claim to knowledge is made, and particularly when we wish to take care that our nonrational insights do not become irrational. The nonrational insight when subjected to criticism may become knowledge. Thus, again applying Schnabel's comments about music analogically to the issue of nonrationalism overall, we find that our nonrational insight and subsequent developments of human knowledge may yet move us "toward that other shore which, to be sure, can only be sighted but never reached" (Schnabel 1942: 14). I will argue in the final chapter that nonrational insight must be sustained by pragmatic criticism if irrational consequences are to be avoided. It is important, then, that we become familiar with some basic principles of reasoning that contribute to pragmatic, rational criticism and fixations of belief. Such principles are focused in studies of logic.

4

Logic and Creativity

Logic comes in two varieties: one sort is narrow and technical, a discipline many find a little frightening; the other is broader and more ingrained in our daily lives, the sort represented by our pragmatic logic of events. Our pragmatic logic itself, however, often depends on the narrower variety, and creativity and criticism are required to use either type of logic properly. In distinguishing the essential differences between these two forms of logic, we find that the Peirce-Marquand logic machine, an early form of the modern computer, can actually perform the operations of a portion of the narrower logic.

WHEN THE ordinary person hears the term "logic," the response is often a mixture of fear and confusion. Logic in the older, broader sense, the overall pragmatic logic of events described in chapter 1, is not ordinarily the object of this fear. Fear of logic generally comes from exposure to one of the narrower and more technical forms of syllogistic, propositional, or quantificational logic. We shall have occasion to find some items from syllogistic and propositional logic useful for the deductive phase of our logic of events. But because fear is only likely to get in the way of our investigation, let us look further into this issue of fear and logic.

Many people have the vague notion that logic has something to do with mathematics, or at least that it *looks* like something mathematical, and because so many people are afraid of mathematics, mentioning "logic" triggers fear. Of course, this association of logic with mathematics, and of mathematics with fear—thus producing an association of logic with fear—is itself *an instance of logical inference.* But even if such fear is abated, the association of logic and mathematics is firm in many people's minds. Look at the following examples from the field of propositional logic and notice how the precise arrangement of symbols and notations suggests similarities with certain forms of mathematics.

Diagram 4.1

$$p :: (p \vee p)$$
$$p :: (p \cdot p)$$
$$(p \vee q) :: (q \vee p)$$
$$(p \cdot q) :: (q \cdot p)$$
$$[p \vee (q \vee r)] :: [(p \vee q) \vee r]$$
$$[p \cdot (q \cdot r)] :: [(p \cdot q) \cdot r]$$
$$[p \cdot (q \vee r)] :: [(p \cdot q) \vee (p \cdot r)]$$
$$[p \vee (q \cdot r)] :: [(p \vee q) \cdot (p \vee r)]$$

(see Hurley 1997: 402; 392)

We will also see that logic is commonly and reasonably associated in people's minds with computers. In fact, we shall investigate an interesting connection between logic and computers a little later.

Those people who have a "deer in the headlights" response to logic usually have the mistaken notion that it is something horribly complicated, dry, and dull in the extreme, riddled with hair-splitting intellectual traps, and therefore either a tiresome drudgery or something to be feared. Because of those vague associations between logic on the one hand and mathematics and computers on the other, those people may think that to become fluent in logic they must learn to think and behave rather like machines, which is not an attractive prospect for most. When they juxtapose what they initially think logic may require against their generally non-mechanistic images of themselves, people simply feel conflicted and uncomfortable.

This sort of internal conflict can be thought of as a pairing or conjunction of contradicting observations or beliefs, one claiming that something *is* the case at a given moment and in some particular aspect, the other, at the very same time and in the very same aspect, claiming that something *is not* the case. For example, the pairing "this electrical switch is now on" and "this electrical switch is now off" represents, given that "now" refers to the same moment in time, a contradiction; the two are contradictory statements. Likewise, the pairing "people *are* really machines, at root" and "people *are not* really so, at root" represents a contradiction. The so-called law of non-contradiction, as a basic ingredient of our thought and understanding, forbids this sort of pairing of contradictory notions. So, if we use 'P' to indicate 'people', the sign '~' to represent 'not', and the sign '·' to represent conjunction or 'and', our dilemma, and the law of non-contradiction, can be tidily summarized as follows: we cannot have 'P · ~P' ('P' and not 'P').

Thus, from our present case arises a seemingly irresolvable friction of a definite sort between two strongly held beliefs, these beliefs being represented by 'P' and '~P'. For how could it be, we ask, that we as human beings are just logical or calculating *machines*? How can the creative part of us—the part that makes guesses and mistakes, the part that uses a "trial and error," experimental, pragmatic approach to solve problems, the part of us that seems to learn, to expand our knowledge, and to allow life to be enjoyable—how can that part of us remain alive if we are defined as and required to behave like such machines? For many of us, this is a serious question that expresses a fundamental doubt about our status in our current era: surely human behavior cannot be utterly standardized and so potentially mechanized, because people are not machines. Yet we can, in *principle* at least, logically resolve this doubt and attendant contradiction.

We have already applied the conjunctive law of non-contradiction, as one side of a coin, to our predicament. We can now employ its disjunctive twin, the so-called "law of excluded middle," from the other side of the same coin to allow us to choose between contradictory options. If we again use 'P' to indicate 'people' and '~' to indicate 'not', but now use 'v' to indicate the disjunctive relation 'or', or better yet, '*either* ___ or ___' we arrive at, not a contradiction, but the disjunction 'P v ~P' (either 'P' or not 'P'). So, logically at least, the intolerable contradiction with its opposed components now becomes, for us, the welcomed disjunction within which a choice between those opposed components can be made. But how can we actually *apply* this seemingly sterile piece of reasoning to our problem of people and machines? Again, in *principle* at least, a relatively easy solution is at hand if we can answer the question, Are human beings really different from machines, be they mathematical machines, logical machines, or otherwise? We can answer this question affirmatively because our creative capacities clearly exceed the limits of machine computability, the limits of following a type of recipe that all computing machines must follow. Put another way, our abilities exceed the limits of following the "fixed method" diagnosed by Peirce in "Our Senses as Reasoning Machines" (1900), quoted in chapter 3.

Obviously, we are different from machines in our pragmatic, experimental ability to be creative. When it comes to mathematics or logic or geology or literature or any other learnable subject matter, achieving a real understanding that persists over time and can be trusted, tested experimentally, and then discarded or retained or improved upon, we really do have to employ all the creativity we can muster. The genuine acquisition and development of human knowledge, therefore, hinges on a critical creativity that allows for that trust and use, encourages testing, permits rejection or maintenance, and delights in conceivable improvement of our knowledge. This long-term creative process is known as experimentalism or pragmatism.

We must make this acquisition and development of knowledge "our own," so to speak. Simple mechanical repetitions or rote memorization of "facts" in the name of satisfying an immediate but transitory demand, like passing an academic or training examination, usually have a predictable outcome. We memorize what is required for some immediate purpose, and as soon as that purpose has passed we more or less thoroughly forget it all. But a different outcome is also possible. If we detect in our array of facts a stable logic or developmental pattern, our memory can actively and creatively secure the information more durably. A computing machine can usefully perform the rather mindless operations involved in the first outcome, and it can perform these operations faster and more reliably than any of us can or ever will. But only a creative, pragmatic intelligence can expect to enjoy the profits available from, but never guaranteed by, the second outcome and the experimental process associated with it.

This brings us to an often-overlooked yet important point about creativity, experimental method, and pragmatism. A certain minimal, indispensable amount of what we sometimes call rote memorization may be necessary at the outset in order to proceed effectively in acquiring and developing genuine knowledge. This is particularly true when we enter some department of knowledge that is completely new to us. Embarking on such a study may require us to memorize some new and fundamental tools, like a specialized vocabulary or an unfamiliar system of abstract notation or some other set of facts and relations, just in the name of "getting started." After the novelty of a new field or task has passed and the new knowledge associated with it can be handled with facility or even habitually, our tentative beginning efforts are often forgotten. By then, we see *why* certain facts and relations behave as they do and not just *how* they so behave. Yet we still retain the basic tools or raw materials that we initially needed to begin our experimental journey toward this region of facility, and we retain these tools by a far more secure procedure than rote memorization. Even though we may sometimes forget information that we think we have carefully stored, we can, in fact, bring it back into play and act upon it. Everyone knows the value of clinging to some facts through rote memorization just long enough to parrot them back for an examination. But it is only through application of those facts and results, through accounting for *why* and not just *how*, that we find a genuine development of knowledge. The often misunderstood phenomenon of biological evolution, about which we shall have more to say later, is an old, yet living and breathing example of this sort of genuine, pragmatic knowledge. Conversely, a mechanical, uncreative and *dogmatic* adoption of any particular "knowledge creed," including misunderstood varieties of pragmatism itself, only blocks the road of inquiry.

An analog in the field of music may help to illustrate at least part of the meaning here. There is a black key roughly in the middle of the keyboard on an ordinary piano, forty-three keys from the bottom of the keyboard and forty-six keys from the top, known as an "E flat." There are six other keys on an ordinary piano keyboard also known as "E flat," but our focus is on the one in the middle. Ordinary musical notation assigns a written mark or sign that corresponds to each and every key on an ordinary piano keyboard. So this one key or note that we call "E flat" has its own, individual, notational sign.

And this particular notation, this mark or sign, corresponds *exactly* to that one note on the piano keyboard and to no other. Each of the other six E flats has its specific and characteristic notation as well. In the nineteenth century the Hungarian-born pianist and composer Franz Liszt composed two piano concertos, the first of which is in the key of E-flat major. Without going into a complicated explanation of what "key" means in this more general sense, it is sufficient for our purposes here to say that this concerto, this work for piano soloist and orchestra, is absolutely loaded with hundreds of E-flats. Here is the point: if one does not somehow already know, through memorization and recall, that these various spots on the musical score correspond exactly and without any exception whatsoever to certain keys on the keyboard, one cannot even begin to learn, much less understand and perform, this concerto. Once the musical and not just the optical association between notation and piano key has been sufficiently established as habit or unconscious response, this mechanical sort of recall can be dispensed with. But in the beginning, for most people, some amount of rote, mechanistic memorization is required for learning to play the piano. Surely our first exposure to any new and strange vocabulary or system of abstract notation must include room for that initial stage of simple memorization and recall. Otherwise, how can we begin?

However that may be, when we genuinely acquire and develop knowledge, we are traveling across a broad continuum or spectrum of