The Reflective Practitioner

HOW PROFESSIONALS THINK IN ACTION

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of established propositions derived from research. When we recognize their limited utility in practice, we experience the dilemma of rigor or relevance. But we may also consider science before the fact as a process in which scientists grapple with uncertainties and display arts of inquiry akin to the uncertainties and arts of practice.

Let us then reconsider the question of professional knowledge; let us stand the question on its head. If the model of Technical Rationality is incomplete, in that it fails to account for practical competence in "divergent" situations, so much the worse for the model. Let us search, instead, for an epistemology of practice implicit in the artistic, intuitive processes which some practitioners do bring to situations of uncertainty, instability, uniqueness, and value conflict.

Reflection-in-Action

When we go about the spontaneous, intuitive performance of the actions of everyday life, we show ourselves to be knowledgeable in a special way. Often we cannot say what it is that we know. When we try to describe it we find ourselves at a loss, or we produce descriptions that are obviously inappropriate. Our knowing is ordinarily tacit, implicit in our patterns of action and in our feel for the stuff with which we are dealing. It seems right to say that our knowing is *in* our action.

Similarly, the workaday life of the professional depends on tacit knowing-in-action. Every competent practitioner can recognize phenomena—families of symptoms associated with a particular disease, peculiarities of a certain kind of building site, irregularities of materials or structures—for which he cannot give a reasonably accurate or complete description. In his

day-to-day practice he makes innumerable judgments of quality for which he cannot state adequate criteria, and he displays skills for which he cannot state the rules and procedures. Even when he makes conscious use of research-based theories and techniques, he is dependent on tacit recognitions, judgments, and skillful performances.

On the other hand, both ordinary people and professional practitioners often think about what they are doing, sometimes even while doing it. Stimulated by surprise, they turn thought back on action and on the knowing which is implicit in action. They may ask themselves, for example, "What features do I notice when I recognize this thing? What are the criteria by which I make this judgment? What procedures am I enacting when I perform this skill? How am I framing the problem that I am trying to solve?" Usually reflection on knowing-in-action goes together with reflection on the stuff at hand. There is some puzzling, or troubling, or interesting phenomenon with which the individual is trying to deal. As he tries to make sense of it, he also reflects on the understandings which have been implicit in his action, understandings which he surfaces, criticizes, restructures, and embodies in further action.

It is this entire process of reflection-in-action which is central to the "art" by which practitioners sometimes deal well with situations of uncertainty, instability, uniqueness, and value conflict.

Knowing-in-action. Once we put aside the model of Technical Rationality, which leads us to think of intelligent practice as an *application* of knowledge to instrumental decisions, there is nothing strange about the idea that a kind of knowing is inherent in intelligent action. Common sense admits the category of know-how, and it does not stretch common sense very much to say that the know-how is *in* the action—that a tightrope walker's know-how, for example, lies in, and is revealed

by, the way he takes his trip across the wire, or that a big-league pitcher's know-how is in his way of pitching to a batter's weakness, changing his pace, or distributing his energies over the course of a game. There is nothing in common sense to make us say that know-how consists in rules or plans which we entertain in the mind prior to action. Although we sometimes think before acting, it is also true that in much of the spontaneous behavior of skillful practice we reveal a kind of knowing which does not stem from a prior intellectual operation.

As Gilbert Ryle has put it,

> What distinguishes sensible from silly operations is not their parentage but their procedure, and this holds no less for intellectual than for practical performances. "Intelligent" cannot be defined in terms of "intellectual" or "knowing *how*" in terms of "knowing *that*"; "thinking what I am doing" does not connote "both thinking what to do and doing it." When I do something intelligently . . . I am doing one thing and not two. My performance has a special procedure or manner, not special antecedents.[50]

And Andrew Harrison has recently put the same thought in this pithy phrase: when someone acts intelligently, he "acts his mind."[51]

Over the years, several writers on the epistemology of practice have been struck by the fact that skillful action often reveals a "knowing more than we can say." They have invented various names for this sort of knowing, and have drawn their examples from different domains of practice.

As early as 1938, in an essay called "Mind in Everyday Affairs," Chester Barnard distinguished "thinking processes" from "non-logical processes" which are not capable of being expressed in words or as reasoning, and which are only made known by a judgment, decision, or action.[52] Barnard's examples include judgments of distance in golf or ball-throwing, a

high-school boy solving quadratic equations, and a practiced accountant who can take "a balance sheet of considerable complexity and within minutes or even seconds get a significant set of facts from it."[53] Such processes may be unconscious or they may occur so rapidly that "they could not be analyzed by the persons in whose brain they take place."[54] Of the high-school mathematician, Barnard says, memorably, "He could not write the text books which are registered in his mind."[55] Barnard believes that our bias toward thinking blinds us to the non-logical processes which are omnipresent in effective practice.

Michael Polanyi, who invented the phrase "tacit knowing," draws examples from the recognition of faces and the use of tools. If we know a person's face, we can recognize it among a thousand, indeed, among a million, though we usually cannot tell how we recognize a face we know. Similarly, we can recognize the moods of the human face without being able to tell, "except quite vaguely,"[56] by what signs we know them. When we learn to use a tool, or a probe or stick for feeling our way, our initial awareness of its impact on our hand is transformed "into a sense of its point touching the objects we are exploring."[57] In Polanyi's phrase, we attend "from" its impact on our hand "to" its effect on the things to which we are applying it. In this process, which is essential to the acquisition of a skill, the feelings of which we are initially aware become internalized in our tacit knowing.

Chris Alexander, in his *Notes Toward a Synthesis of Form,*[58] considers the knowing involved in design. He believes that we can often recognize and correct the "bad fit" of a form to its context, but that we usually cannot describe the rules by which we find a fit bad or recognize the corrected form to be good. Traditional artifacts evolve culturally through successive detections and corrections of bad fit until

the resulting forms are good. Thus for generations the Slovakian peasants made beautiful shawls woven of yarns which had been dipped in homemade dyes. When aniline dyes were made available to them, "the glory of the shawls was spoiled."[59] The shawlmakers had no innate ability to make good shawls but "were simply able, as many of us are, to recognize bad shawls and their own mistakes. Over the generations . . . whenever a bad one was made, it was recognized as such, and therefore not repeated."[60] The introduction of aniline dyes disrupted the cultural process of design, for the shawlmakers could not produce wholly new designs of high quality; they could only recognize "bad fit" within a familiar pattern.

Ruminating on Alexander's example, Geoffrey Vickers points out that it is not only artistic judgments which are based on a sense of form which cannot be fully articulated:

> artists, so far from being alone in this, exhibit most clearly an oddity which is present in all such judgments. We can recognize and describe deviations from a norm very much more clearly than we can describe the norm itself.[61]

For Vickers, it is through such tacit norms that all of us make the judgments, the qualitative appreciations of situations, on which our practical competence depends.

Psycholinguists have noted that we speak in conformity with rules of phonology and syntax which most of us cannot describe.[62] Alfred Schultz and his intellectual descendants have analyzed the tacit, everyday know-how that we bring to social interactions such as the rituals of greeting, ending a meeting, or standing in a crowded elevator.[63] Birdwhistell has made comparable contributions to a description of the tacit knowledge embodied in our use and recognition of movement and gesture.[64] In these domains, too, we behave according to rules

and procedures that we cannot usually describe and of which we are often unaware.

In examples like these, knowing has the following properties:

- There are actions, recognitions, and judgments which we know how to carry out spontaneously; we do not have to think about them prior to or during their performance.
- We are often unaware of having learned to do these things; we simply find ourselves doing them.
- In some cases, we were once aware of the understandings which were subsequently internalized in our feeling for the stuff of action. In other cases, we may never have been aware of them. In both cases, however, we are usually unable to describe the knowing which our action reveals.

It is in this sense that I speak of knowing-*in-* action, the characteristic mode of ordinary practical knowledge.

Reflecting-in-action. If common sense recognizes knowing-in-action, it also recognizes that we sometimes think about what we are doing. Phrases like "thinking on your feet," "keeping your wits about you," and "learning by doing" suggest not only that we can think about doing but that we can think about doing something while doing it. Some of the most interesting examples of this process occur in the midst of a performance.

Big-league baseball pitchers speak, for example, of the experience of "finding the groove":

Only a few pitchers can control the whole game with pure physical ability. The rest have to learn to adjust once they're out there. If they can't, they're dead ducks.

[You get] a special feel for the ball, a kind of command that lets you repeat the exact same thing you did before that proved successful.

Finding your groove has to do with studying those winning habits and trying to repeat them every time you perform.[65]

I do not wholly understand what it means to "find the groove."
It is clear, however, that the pitchers are talking about a partic-
ular kind of reflection. What is "learning to adjust once you're
out there"? Presumably it involves noticing how you have been
pitching to the batters and how well it has been working, and
on the basis of these thoughts and observations, changing the
way you have been doing it. When you get a "feel for the ball"
that lets you "repeat the exact same thing you did before that
proved successful," you are noticing, at the very least, that you
have been doing something right, and your "feeling" allows
you to do that something again. When you "study those win-
ning habits," you are thinking about the know-how that has
enabled you to win. The pitchers seem to be talking about a
kind of reflection on their patterns of action, on the situations
in which they are performing, and on the know-how implicit
in their performance. They are reflecting *on* action and, in
some cases, reflecting *in* action.

When good jazz musicians improvise together, they also
manifest a "feel for" their material and they make on-the-spot
adjustments to the sounds they hear. Listening to one another
and to themselves, they feel where the music is going and ad-
just their playing accordingly. They can do this, first of all, be-
cause their collective effort at musical invention makes use of
a schema—a metric, melodic, and harmonic schema familiar
to all the participants—which gives a predictable order to the
piece. In addition, each of the musicians has at the ready a
repertoire of musical figures which he can deliver at appropri-
ate moments. Improvisation consists in varying, combining,
and recombining a set of figures within the schema which
bounds and gives coherence to the performance. As the musi-
cians feel the direction of the music that is developing out of
their interwoven contributions, they make new sense of it and
adjust their performance to the new sense they have made.

They are reflecting-in-action on the music they are collectively making and on their individual contributions to it, thinking what they are doing and, in the process, evolving their way of doing it. Of course, we need not suppose that they reflect-in-action in the medium of words. More likely, they reflect through a "feel for the music" which is not unlike the pitcher's "feel for the ball."

Much reflection-in-action hinges on the experience of surprise. When intuitive, spontaneous performance yields nothing more than the results expected for it, then we tend not to think about it. But when intuitive performance leads to surprises, pleasing and promising or unwanted, we may respond by reflecting-in-action. Like the baseball pitcher, we may reflect on our "winning habits"; or like the jazz musician, on our sense of the music we have been making; or like the designer, on the misfit we have unintentionally created. In such processes, reflection tends to focus interactively on the outcomes of action, the action itself, and the intuitive knowing implicit in the action.

Let us consider an example which reveals these processes in some detail.

In an article entitled "If you want to get ahead, get a theory," Inhelder and Karmiloff-Smith[66] describe a rather unusual experiment concerning "children's processes of discovery in action."[67] They asked their subjects to balance wooden blocks on a metal bar. Some of the blocks were plain wooden blocks, but others were conspicuously or inconspicuously weighted at one end. The authors attended to the spontaneous processes by which the children tried to learn about the properties of the blocks, balance them on the bar, and regulate their actions after success or failure.

They found that virtually all children aged six to seven began the task in the same way:

all blocks were systematically first tried at their geometric center.[68]

And they found that slightly older children would not only place all blocks at their geometric center but that

> when asked to add small blocks of varying shapes and sizes to blocks already in balance, they added up to ten blocks precariously one on top of the other at the geometric center rather than distributing them at the extremities.[69]

They explain this persistent and virtually universal behavior by attributing to the children what they call a "theory-in-action": a "geometric center theory" of balancing, or, as one child put it, a theory that "things always balance in the middle."

Of course, when the children tried to balance the counterweighted blocks at their geometric centers, they failed. How did they respond to failure? Some children made what the authors called an "action-response."

> They now placed the very same blocks more and more systematically at the geometric center, with only very slight corrections around this point. They showed considerable surprise at not being able to balance the blocks a second time ("Heh, what's gone wrong with this one, it worked before") . . . Action sequences then became reduced to: Place carefully at geometric center, correct very slightly around this center, abandon all attempts, declaring the object "impossible" to balance.[70]

Other children, generally between the ages of seven and eight, responded in a very different way. When the counterweighted blocks failed to balance at their geometric centers, these children began to de-center them. They did this first with conspicuously counterweighted blocks. Then

> gradually, and often almost reluctantly, the 7 to 8 year olds' began to make corrections also on the inconspicuous weight blocks

At this point, we observed 'many pauses during action sequences on the inconspicuous weight items.[71]

Later still,

As the children were now really beginning to question the generality of their geometric center theory, a negative response at the geometric center sufficed to have the child rapidly make corrections toward the point of balance.[72]

And finally,

children paused *before* each item, roughly assessed the weight distribution of the block by lifting it ("you have to be careful, sometimes it's just as heavy on each side, sometimes it's heavier on one side"), inferred the probable point of balance and then placed the object immediately very close to it, without making any attempts at first balancing at the geometric center.[73]

The children now behaved as though they had come to hold a theory-in-action that blocks balance, not at their geometric centers, but at their centers of gravity.

This second pattern of response to error, the authors call "theory-response." Children work their way toward it through a series of stages. When they are first confronted with a number of events which refute their geometric center theories-in-action, they stop and think. Then, starting with the conspicuous-weight blocks, they begin to make corrections away from the geometric center. Finally, when they have really abandoned their earlier theories-in-action, they weigh all the blocks in their hands so as to infer the probable point of balance. As they shift their theories of balancing from geometric center to center of gravity, they also shift from a "success orientation" to a "theory orientation." Positive and negative results come

to be taken not as signs of success or failure in action but as information relevant to a theory of balancing.

It is interesting to note that as the authors observe and describe this process, they are compelled to invent a language. They describe theories-in-action which the children themselves cannot describe.

> Indeed, although the (younger) child's action sequences bear eloquent witness to a theory-in-action implicit in his behavior, this should not be taken as a capacity to conceptualize explicitly on what he is doing and why.[74]

Knowing-in-action which the child may represent to himself in terms of a "feel for the blocks," the observers redescribe in terms of "theories." I shall say that they convert the child's know*ing*-in-action to know*ledge*-in-action.

A conversion of this kind seems to be inevitable in any attempt to talk about reflection-in-action. One must use words to describe a kind of knowing, and a change of knowing, which are probably not originally represented in words at all. Thus, from their observations of the children's behavior, the authors make verbal descriptions of the children's intuitive understandings. These are the authors' theories about the children's knowing-in-action. Like all such theories, they are deliberate, idiosyncratic constructions, and they can be put to experimental test:

> just as the child was constructing a theory-in-action in his endeavor to balance the blocks, so we, too, were making on-the-spot hypotheses about the child's theories and providing opportunities for negative and positive responses in order to verify our own theories![75]

Reflecting-in-practice The block-balancing experiment is a beautiful example of reflection-in-action, but it is very far removed from our usual images of professional practice: If we

are to relate the idea of reflection-in-action to professional practice, we must consider what a practice is and how it is like and unlike the kinds of action we have been discussing.

The word "practice" is ambiguous. When we speak of a lawyer's practice, we mean the kinds of things he does, the kinds of clients he has, the range of cases he is called upon to handle. When we speak of someone practicing the piano, however, we mean the repetitive or experimental activity by which he tries to increase his proficiency on the instrument. In the first sense, "practice" refers to performance in a range of professional situations. In the second, it refers to preparation for performance. But professional practice also includes an element of repetition. A professional practitioner is a specialist who encounters certain types of situations again and again. This is suggested by the way in which professionals use the word "case"—or project, account, commission, or deal, depending on the profession. All such terms denote the units which make up a practice, and they denote types of family-resembling examples. Thus a physician may encounter many different "cases of measles"; a lawyer, many different "cases of libel." As a practitioner experiences many variations of a small number of types of cases, he is able to "practice" his practice. He develops a repertoire of expectations, images, and techniques. He learns what to look for and how to respond to what he finds. As long as his practice is stable, in the sense that it brings him the same types of cases, he becomes less and less subject to surprise. His knowing-in-practice tends to become increasingly tacit, spontaneous, and automatic, thereby conferring upon him and his clients the benefits of specialization.

On the other hand, professional specialization can have negative effects. In the individual, a high degree of specialization can lead to a parochial narrowness of vision. When a profession

divides into subspecialties, it can break apart an earlier whole-ness of experience and understanding. Thus people sometimes yearn for the general practitioner of earlier days, who is thought to have concerned himself with the "whole patient," and they sometimes accuse contemporary specialists of treating particular illnesses in isolation from the rest of the patient's life experience. Further, as a practice becomes more repetitive and routine, and as knowing-in-practice becomes increasingly tacit and spontaneous, the practitioner may miss important op-portunities to think about what he is doing. He may find that, like the younger children in the block-balancing experiment, he is drawn into patterns of error which he cannot correct. And if he learns, as often happens, to be selectively inattentive to phenomena that do not fit the categories of his knowing-in-action, then he may suffer from boredom or "burn-out" and afflict his clients with the consequences of his narrowness and rigidity. When this happens, the practitioner has "over-learned" what he knows.

A practitioner's reflection can serve as a corrective to over-learning. Through reflection, he can surface and criticize the tacit understandings that have grown up around the repetitive experiences of a specialized practice, and can make new sense of the situations of uncertainty or uniqueness which he may allow himself to experience.

Practitioners do reflect *on* their knowing-in-practice. Some-times, in the relative tranquility of a postmortem, they think back on a project they have undertaken, a situation they have lived through, and they explore the understandings they have brought to their handling of the case. They may do this in a mood of idle speculation, or in a deliberate effort to prepare themselves for future cases.

But they may also reflect on practice while they are in the

midst of it. Here they reflect-in-action, but the meaning of this term needs now to be considered in terms of the complexity of knowing-in-practice.

A practitioner's reflection-in-action may not be very rapid. It is bounded by the "action-present," the zone of time in which action can still make a difference to the situation. The action-present may stretch over minutes, hours, days, or even weeks or months, depending on the pace of activity and the situational boundaries that are characteristic of the practice. Within the give-and-take of courtroom behavior, for example, a lawyer's reflection-in-action may take place in seconds; but when the context is that of an antitrust case that drags on over years, reflection-in-action may proceed in leisurely fashion over the course of several months. An orchestra conductor may think of a single performance as a unit of practice, but in another sense a whole season is his unit. The pace and duration of episodes of reflection-in-action vary with the pace and duration of the situations of practice.

When a practitioner reflects in and on his practice, the possible objects of his reflection are as varied as the kinds of phenomena before him and the systems of knowing-in-practice which he brings to them. He may reflect on the tacit norms and appreciations which underlie a judgment, or on the strategies and theories implicit in a pattern of behavior. He may reflect on the feeling for a situation which has led him to adopt a particular course of action, on the way in which he has framed the problem he is trying to solve, or on the role he has constructed for himself within a larger institutional context.

Reflection-in-action, in these several modes, is central to the art through which practitioners sometimes cope with the troublesome "divergent" situations of practice.

When the phenomenon at hand eludes the ordinary categories of knowledge-in-practice, presenting itself as unique or un-

stable, the practitioner may surface and criticize his initial understanding of the phenomenon, construct a new description of it, and test the new description by an on-the-spot experiment. Sometimes he arrives at a new theory of the phenomenon by articulating a feeling he has about it.

When he finds himself stuck in a problematic situation which he cannot readily convert to a manageable problem, he may construct a new way of setting the problem—a new frame which, in what I shall call a "frame experiment," he tries to impose on the situation.

When he is confronted with demands that seem incompatible or inconsistent, he may respond by reflecting on the appreciations which he and others have brought to the situation. Conscious of a dilemma, he may attribute it to the way in which he has set his problem, or even to the way in which he has framed his role. He may then find a way of integrating, or choosing among, the values at stake in the situation.

The following are brief examples of the kinds of reflection-in-action which I shall illustrate and discuss at greater length later on.

An investment banker, speaking of the process by which he makes his judgments of investment risk, observes that he really cannot describe everything that goes into his judgments. The ordinary rules of thumb allow him to calculate "only 20 to 30 percent of the risk in investment." In terms of the rules of thumb, a company's operating numbers may be excellent. Still, if the management's explanation of the situation does not fit the numbers, or if there is something odd in the behavior of the people, that is a subject for worry which must be considered afresh in each new situation. He recalls a situation in which he spent a day with one of the largest banks in Latin America. Several new business proposals were made to him, and the bank's operating numbers seemed satisfactory. Still, he had a

gnawing feeling that something was wrong. When he thought about it, it seemed that he was responding to the fact that he had been treated with a degree of deference out of all proportion to his actual position in the international world of banking. What could have led these bankers to treat him so inappropriately? When he left the bank at the end of the day, he said to his colleague, "No new business with that outfit! Let the existing obligations come in, but nothing new!" Some months later, the bank went through the biggest bankruptcy ever in Latin America—and all the time there had been nothing wrong with the numbers.

An ophthalmologist says that a great many of his patients bring problems that are not in the book. In 80 or 85 percent of the cases, the patient's complaints and symptoms do not fall into familiar categories of diagnosis and treatment. A good physician searches for new ways of making sense of such cases, and invents experiments by which to test his new hypotheses. In a particularly important family of situations, the patient suffers simultaneously from two or more diseases. While each of these, individually, lends itself to familiar patterns of thought and action, their combination may constitute a unique case that resists ordinary approaches to treatment.

The ophthalmologist recalls one patient who had inflammation of the eye (uveitis) combined with glaucoma. The treatment for glaucoma aggravated the inflammation, and the treatment for uveitis aggravated the glaucoma. When the patient came in, he was already under treatment at a level insufficient for cure but sufficient to irritate the complementary disease.

The ophthalmologist decided to remove all treatment and wait to see what would emerge. The result was that the patient's uveitis, a parasitic infection, remained in much reduced form. On the other hand, the glaucoma disappeared altogether, thus proving to have been an artifact of the treatment. The

opthalmologist then began to "titrate" the patient. Working with very small quantities of drugs, he aimed not at total cure but at a reduction of symptoms which would allow the patient to go back to work. (Seven lives depended on his 5000 ocular cells!) The prognosis was not good, for uveitis moves in cycles and leaves scars behind which impede vision. But for the time being, the patient was able to work.

In his mid-thirties, sometime between the composition of his early work *The Cossacks* and his later *War and Peace*, Lev Nikolayevitch Tolstoy became interested in education. He started a school for peasant children on his estate at Yasnaya Polanya, he visited Europe to learn the latest educational methods, and he published an educational journal, also called *Yasnaya Polanya*. Before he was done (his new novel eventually replaced his interest in education), he had built some seventy schools, had created an informal teacher-training program, and had written an exemplary piece of educational evaluation.

For the most part, the methods of the European schools filled him with disgust, yet he was entranced by Rousseau's writings on education. His own school anticipated John Dewey's later approach to learning by doing, and bore the stamp of his conviction that good teaching required "not a method but an art." In an essay, "On Teaching the Rudiments," he describes his notion of art in the teaching of reading:

> Every individual must, in order to acquire the art of reading in the shortest possible time, be taught quite apart from any other, and therefore there must be a separate method for each. That which forms an insuperable difficulty to one does not in the least keep back another, and vice versa. One pupil has a good memory, and it is easier for him to memorize the syllables than to comprehend the vowellessness of the consonants; another reflects calmly and will comprehend a most rational sound method; another has

a fine instinct, and he grasps the law of word combinations by reading whole words at a time.

The best teacher will be he who has at his tongue's end the explanation of what it is that is bothering the pupil. These explanations give the teacher the knowledge of the greatest possible number of methods, the ability of inventing new methods and, above all, not a blind adherence to one method but the conviction that all methods are one-sided, and that the best method would be the one which would answer best to all the possible difficulties incurred by a pupil, that is, not a method but an art and talent.

. . . Every teacher must . . . by regarding every imperfection in the pupil's comprehension, not as a defect of the pupil, but as a defect of his own instruction, endeavor to develop in himself the ability of discovering new methods . . . [76]

An artful teacher sees a child's difficulty in learning to read not as a defect in the child but as a defect "of his own instruction." So he must find a way of explaining what is bothering the pupil. He must do a piece of experimental research, then and there, in the classroom. And because the child's difficulties may be unique, the teacher cannot assume that his repertoire of explanations will suffice, even though they are "at the tongue's end." He must be ready to invent new methods and must "endeavor to develop in himself the ability of discovering them."

Over the last two years, researchers at the Massachusetts Institute of Technology have undertaken a program of in-service education for teachers, a program organized around the idea of on-the-spot reflection and experiment, very much as in Tolstoy's art of teaching. In this Teacher Project,[77] the researchers have encouraged a small group of teachers to explore their own intuitive thinking about apparently simple tasks in such domains as mathematics, physics, music, and the perceived behavior of the moon. The teachers have made some important

discoveries. They have allowed themselves to become confused about subjects they are supposed to "know"; and as they have tried to work their way out of their confusions, they have also begun to think differently about learning and teaching.

Early in the project, a critical event occured. The teachers were asked to observe and react to a videotape of two boys engaged in playing a simple game. The boys sat at a table, separated from one another by an opaque screen. In front of one boy, blocks of various colors, shapes, and sizes were arranged in a pattern. In front of the other, similar blocks were lying on the table in no particular order. The first boy was to tell the second one how to reproduce the pattern. After the first few instructions, however, it became clear that the second boy had gone astray. In fact, the two boys had lost touch with one another, though neither of them knew it.

In their initial reactions to the videotape, the teachers spoke of a "communications problem." They said that the instruction giver had "well-developed verbal skills" and that the receiver was "unable to follow directions." Then one of the researchers pointed out that, although the blocks contained no green squares—all squares were orange and only triangles were green—she had heard the first boy tell the second to "take a green square." When the teachers watched the videotape again, they were astonished. That small mistake had set off a chain of false moves. The second boy had put a green thing, a triangle, where the first boy's pattern had an orange square, and from then on all the instructions became problematic. Under the circumstances, the second boy seemed to have displayed considerable ingenuity in his attempts to reconcile the instructions with the pattern before him.

At this point, the teachers reversed their picture of the situation. They could see why the second boy behaved as he did. He no longer seemed stupid; he had, indeed, "followed instruc-

tions." As one teacher put it, they were now "giving him reason." They saw reasons for his behavior; and his errors, which they had previously seen as an inability to follow directions, they now found reasonable.

Later on in the project, as the teachers increasingly challenged themselves to discover the meanings of a child's puzzling behavior, they often spoke of "giving him reason."

In examples such as these, something falls outside the range of ordinary expectations. The banker has a feeling that something is wrong, though he cannot at first say what it is. The physician sees an odd combination of diseases never before described in a medical text. Tolstoy thinks of each of his pupils as an individual with ways of learning and imperfections peculiar to himself. The teachers are astonished by the sense behind a student's mistake. In each instance, the practitioner allows himself to experience surprise, puzzlement, or confusion in a situation which he finds uncertain or unique. He reflects on the phenomena before him, and on the prior understandings which have been implicit in his behavior. He carries out an experiment which serves to generate both a new understanding of the phenomena and a change in the situation.

When someone reflects-in-action, he becomes a researcher in the practice context. He is not dependent on the categories of established theory and technique, but constructs a new theory of the unique case. His inquiry is not limited to a deliberation about means which depends on a prior agreement about ends. He does not keep means and ends separate, but defines them interactively as he frames a problematic situation. He does not separate thinking from doing, ratiocinating his way to a decision which he must later convert to action. Because his experimenting is a kind of action, implementation is built into his inquiry. Thus reflection-in-action can proceed, even

in situations of uncertainty or uniqueness, because it is not bound by the dichotomies of Technical Rationality.

Although reflection-in-action is an extraordinary process, it is not a rare event. Indeed, for some reflective practitioners it is the core of practice. Nevertheless, because professionalism is still mainly identified with technical expertise, reflection-in-action is not generally accepted—even by those who do it—as a legitimate form of professional knowing.

Many practitioners, locked into a view of themselves as technical experts, find nothing in the world of practice to occasion reflection. They have become too skillful at techniques of selective inattention, junk categories, and situational control, techniques which they use to preserve the constancy of their knowledge-in-practice. For them, uncertainty is a threat; its admission is a sign of weakness. Others, more inclined toward and adept at reflection-in-action, nevertheless feel profoundly uneasy because they cannot say what they know how to do, cannot justify its quality or rigor.

For these reasons, the study of reflection-in-action is critically important. The dilemma of rigor or relevance may be dissolved if we can develop an epistemology of practice which places technical problem solving within a broader context of reflective inquiry, shows how reflection-in-action may be rigorous in its own right, and links the art of practice in uncertainty and uniqueness to the scientist's art of research. We may thereby increase the legitimacy of reflection-in-action and encourage its broader, deeper, and more rigorous use.

frames and theories of their own. He will see them not only as objects to be planned for but as planners in their own right, and his interaction with them will take the form of a reflective conversation.

In these ways, among others, differences in the constants brought to inquiry affect the scope and direction of reflection-in-action. But the constants—media, language, repertoire, appreciative system, overarching theory, and role frame—are also subject to change. They tend to change over periods of time longer than a single episode of practice, although particular events may trigger their change. And they are sometimes changed through the practitioner's reflection on the events of his practice. The study of these sorts of reflection, crucial both to professional development and to the epistemology of practice, would require a more sustained longitudinal analysis than any I have attempted in the chapters of this book.

The Limits of Reflection-in-Action

What is it that constrains our ability to reflect-in-action? To what extent are such constraints inherent in the human situation or in the epistemology of practice, and to what extent can we learn to transcend them?

Our examples suggest that practitioners do frequently think about what they are doing while doing it. In professional practice, reflection-in-action is not a rare event. On the other hand, we have also seen how systems of knowing-in-practice may limit the scope and depth of reflection.

The first finding disconfirms the rather widespread belief that thinking must interfere with doing. The second draws attention to the self-limiting character of knowing-in-practice,

both in individuals and organizations, and suggests the directions in which such limits might be extended.

According to conventional wisdom, thinking interferes with doing in two ways. First, artistry being indescribable, reflection *on* action is doomed to failure; and second, reflection-*in*-action paralyzes action. Both arguments are largely, though not entirely, mistaken. They owe their plausibility to the persistence of misleading views about the relation of thought to action.

As to the first argument, I have already noted that "artistry" has two meanings. It may designate intuitive knowing, like the intuitive judgments of a skilled craftsman or the intuitive theories-in-action of an expert block balancer. It may also designate reflection-in-action on intuitive knowing, as in Quist's designing or the Supervisor's interpreting. In both of these senses, artistry is describable. When practitioners reflect-in-action, they describe their own intuitive understandings. And it is possible to describe reflection-in-action itself, as I have done in the previous chapters.

It is true, nevertheless, that there is always a gap between such descriptions and the reality to which they refer. When a practitioner displays artistry, his intuitive knowing is always richer in information than any description of it. Further, the internal strategy of representation, embodied in the practitioner's *feel for* artistic performance, is frequently incongruent with the strategies used to construct external descriptions of it. Because of this incongruity, for example, people who do things well often give what appear to be good descriptions of their procedures which others cannot follow. Everyone who has tried to learn from a book how to ski or write a story knows how difficult it can be to act from such a description.

But the gap between artistry and its description need not obstruct reflection-in-action. In such examples as Quist's re-

flection on Petra's framing of the problem of the site or the block balancer's reflection on his geometric center theory of balancing, the description of intuitive knowing feeds reflection, enabling the inquirer to criticize, test, and restructure his understandings. Incompleteness of description is no impediment to reflection. On the contrary, anything like a complete description of intuitive knowing would produce an excess of information. Nor is it a fatal impediment that reflection-in-action converts one's intuitive feel for performance to knowledge-in-practice which involves a different strategy of representation. Reflection-in-action does not depend on a description of intuitive knowing that is complete or faithful to internal representation. Although some descriptions are more appropriate to reflection-in-action than others, descriptions that are not very good may be good enough to enable an inquirer to criticize and restructure his intuitive understandings so as to produce new actions that improve the situation or trigger a reframing of the problem.

Even if reflection-in-action is feasible, however, it may seem dangerous. The baseball pitcher who claims never to think about his pitching in the midst of a game, and the famous story of the centipede paralyzed by the attempt to explain how he moves, suggest that reflection interferes with action. It may seem to do so for four different reasons:

1. There is no time to reflect when we are on the firing line; if we stop to think, we may be dead.
2. When we think about what we are doing, we surface complexity, which interferes with the smooth flow of action. The complexity that we can manage unconsciously paralyzes us when we bring it to consciousness.
3. If we begin to reflect-in-action, we may trigger an infinite regress of reflection on action, then on our reflection on action, and so on ad infinitum.

4. The stance appropriate to reflection is incompatible with the stance appropriate to action. As Hannah Arendt has said,

> Every reflection that does not serve knowledge and is not guided by practical needs and aims is . . . "out of order" . . . it interrupts any doing, any ordinary activities, no matter what they happen to be. All thinking demands a *stop-and-think* . . . it is, indeed, as though thinking paralyzed me in much the same way as an excess of consciousness may paralyze the automatism of my bodily function.[2]

So understood, reflection-in-action is a contradiction in terms.

These arguments admit the possibility of reflecting *on* action (even the pitcher who never "thinks" during the game is happy to review films of the game in the privacy and safety of the locker-room), but they point to the dangers of reflection *in* action. They contain grains of truth, but they depend on a mistaken view of the relationship between thought and action. Fused together in the conventional wisdom, they have become a myth that reinforces the ever-present tendency to mystify the art of practice.

There are indeed times when it is dangerous to stop and think. On the firing line, in the midst of traffic, even on the playing field, there is a need for immediate, on-line response, and the failure to deliver it can have serious consequences. But not all practice situations are of this sort. The action-present (the period of time in which we remain in the "same situation") varies greatly from case to case, and in many cases there is time to think what we are doing. Consider, for example, a physician's management of a patient's disease, a lawyer's preparation of a brief, a teacher's handling of a difficult student. In processes such as these, which may extend over weeks, months, or years, fast-moving episodes are punctuated by intervals which provide opportunity for reflection.

Even when the action-present is brief, performers can sometimes train themselves to think about their actions. In the split-second exchanges of a game of tennis, a skilled player learns to give himself a moment to plan the next shot. His game is the better for this momentary hesitation, so long as he gauges the time available for reflection correctly and integrates his reflection into the smooth flow of action. And we have observed how practitioners like architects, musicians, and therapists construct virtual worlds in which the pace of action can be slowed down and iterations and variations of actions can be tried. Indeed, our conception of the art of practice ought to give a central place to the ways in which practitioners learn to create opportunities for reflection-in-action.

The argument from the inherent complexity of intuitive knowing raises again the question of what constitutes a good description of action. Speaking of the centipede's paralysis, Seymour Papert once observed that the difficulty is not in the inherent complexity of the material brought to consciousness but in our ways of representing complexity. Certain descriptions are more useful for action than are others. The centipede might have given a nonparalyzing answer to the question, "How do you do it?" by saying simply, "I move forward in a wavy motion." A good coach learns to capture the complexity of action in metaphor ("Lean into the slope!") that helps to convey the feel for the performance.

On the other hand, some very useful prescriptions for action do temporarily interfere with performance. Someone learning to play tennis or golf or a musical instrument may be asked to change his grip (or his embouchure) with the expectation that he will lose spontaneity for a time before recapturing it at a higher level of quality. Here we are not surprised to find that reflection does temporarily inhibit action. Whether or not we are prepared to pay this price depends on our ability to find

a context in which we can practice at low risk, or on our judg-
ment of the value of incurring a temporary loss of spontaneity.
In any case, we are most likely to initiate reflection-in-action
when we are stuck or seriously dissatisfied with our perfor-
mance. Our question then is not so much *whether* to reflect
as *what kind* of reflection is most likely to help us get unstuck.

The fear that reflection-in-action will trigger an infinite re-
gress of reflection derives from an unexamined dichotomy of
thought and action. If we separate thinking from doing, seeing
thought only as a preparation for action and action only as an
implementation of thought, then it is easy to believe that when
we step into the separate domain of thought we will become
lost in an infinite regress of thinking about thinking. But in
actual reflection-in-action, as we have seen, doing and thinking
are complementary. Doing extends thinking in the tests,
moves, and probes of experimental action, and reflection feeds
on doing and its results. Each feeds the other, and each sets
boundaries for the other. It is the surprising result of action
that triggers reflection, and it is the production of a satisfactory
move that brings reflection temporarily to a close. It is true,
certainly, that an inquirer's continuing conversation with his
situation may lead, open-endedly, to renewal of reflection.
When a practitioner keeps inquiry moving, however, he does
not abstain from action in order to sink into endless thought.
Continuity of inquiry entails a continual interweaving of think-
ing and doing.

Finally, Hannah Arendt's observation that reflection is "out
of order" in action may seem valid or invalid depending on
the kind of reflection one has in mind. It is not hard to imagine
reflection "not guided by practical needs and aims" which
might distract an actor or cause him to cease acting altogether.
This may appear a good or bad thing, depending on one's view
of the action in question. Some advisors to President Johnson

during the Vietnam War years have recorded the feeling that in the councils of war their skeptical reflections always seemed impractical and out of order.[3] In such a case, the interruption of action by reflection might seem heroic. In other, less dramatic instances, reflection incongruent with a present course of action may be maintained through double vision. Double vision does not require us to stop and think, but the capacity to keep alive, in the midst of action, a multiplicity of views of the situation. It does not interfere with action but contributes to the inquirer's readiness for the mode of action I have called reflective conversation with the situation.

There is nothing in reflection, then, which leads necessarily to paralysis of action. The fear of paralysis may spring from worst-case analysis which ignores the opportunities for reflection within the action-present, from neglect of our ability to construct virtual worlds in which the pace of action can be slowed down, from ignorance of double vision, from inability to imagine descriptions useful for action, or from an inappropriate dichotomy of thinking and doing.

In actual practice, practitioners do, without paralysis, reflect-in-action. The fear of a paralysis induced by reflection, like the belief in the indescribability of artistry, comes not from the experience of practice but from a lingering model of practical rationality which is much in need of reflection.

Quite different from the mythical limits to reflection, celebrated in the conventional wisdom, are the self-reinforcing systems of knowing-in-practice that we have encountered in some of our case studies of professional practice.

The town planner in our example reflects on his strategies of problem solving but not on his problem settings or on the role frame and theory of action from which they derive. The consumer product managers reflect on their organizational crises but not on the organizational learning system that fosters

crises. Their reflections operate *within* their systems of understanding. The town planner, who takes his balancing act as a given, reflects only on the techniques best suited to its performance. The product development managers, who treat their learning system as unchangeable, think only about the best ways of patching it. Similarly, in the dialogues of Quist and Petra and the Supervisor and the Resident, there is a great deal of artistry (which involves reflection-in-action) but very little second-order reflection either on artistry or on the interaction between teacher and student.

It seems to me that the processes which maintain the constancy of individual and organizational systems of knowing-in-practice are also the ones that keep the art of practice mysterious. When a practitioner does not reflect on his own inquiry, he keeps his intuitive understandings tacit *and* is inattentive to the limits of his scope of reflective attention. The remedy to the mystification of practice and to the constriction of reflection-in-action is the same: a redirection of attention to the system of knowing-in-practice and to reflection-in-action itself. Quist and the Supervisor should be thinking about the art that they demonstrate for their students, and about the interactions in which they demonstrate it. The town planner should be thinking about his limited reflection-in-action, and about the balancing act within which he frames his practice. The managers of the consumer products firm should be reflecting on their patching exercises and on the organizational learning system that requires patching.

But this is circular. What keeps the planner, for example, from reflecting on his balancing act is his self-reinforcing system of knowing-in-practice. The system makes itself immune to reflection, thereby protecting the planner from the uncertainty (and perhaps also from the paralysis) he would experience if he were to allow his system to come apart. A practi-

tioner might break into a circle of self-limiting reflection by attending to his role frame, his interpersonal theory-in-use, or the organizational learning system in which he functions. Whatever his starting point, however, he is unlikely to get very far unless he wants to extend and deepen his reflection-in-action, and unless others help him see what he has worked to avoid seeing.

The pursuit of these questions, critical to a theory of education for reflection-in-action, would take us well beyond the scope of this book.