TACIT KNOWING

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SOME OF you may know that I turned to philosophy as an afterthought to my career as a scientist. I would like to tell you what I was after in making this change, for it will also explain the general task to which my present lecture should introduce us.

I first met questions of philosophy when I came up against the Soviet ideology under Stalin which denied justification to the pursuit of science. I remember a conversation I had with Bukharin in Moscow in 1935. Though he was heading toward his fall and execution three years later, he was still a leading theoretician of the Communist party. When I asked him about the pursuit of pure science in Soviet Russia, he said that pure science was a morbid symptom of a class society; under socialism the conception of science pursued for its own sake would disappear, for the interests of scientists would spontaneously turn to problems of the current Five-Year Plan.

I was struck by the fact that this denial of the very existence of independent scientific thought came from a socialist theory which derived its tremendous persuasive power from its claim to scientific certainty. The scientific outlook appeared to have produced a mechanical conception of man and history in which there was no place for science itself. This conception denied altogether any intrinsic

power to thought and thus denied also any grounds for claiming freedom of thought.

I saw also that this self-immolation of the mind was actuated by powerful moral motives. The mechanical course of history was to bring universal justice. Scientific skepticism would trust only material necessity for achieving universal brotherhood. Skepticism and utopianism had thus fused into a new skeptical fanaticism.

It seemed to me then that our whole civilization was pervaded by the dissonance of an extreme critical lucidity and an intense moral conscience, and that this combination had generated both our tight-lipped modern revolutions and the tormented self-doubt of modern man outside revolutionary movements. So I resolved to inquire into the roots of this condition.

My search has led me to a novel idea of human knowledge from which a harmonious view of thought and existence, rooted in the universe, seems to emerge.

I shall reconsider human knowledge by starting from the fact that *we can know more than we can tell*. This fact seems obvious enough; but it is not easy to say exactly what it means. Take an example. We know a person's face, and can recognize it among a thousand, indeed among a million. Yet we usually cannot tell how we recognize a face we know. So most of this knowledge cannot be put into words. But the police have recently introduced a method by which we can communicate much of this knowledge. They have made a large collection of pictures showing a variety of noses, mouths, and other features. From these the witness selects the

particulars of the face he knows, and the pieces can then be put together to form a reasonably good likeness of the face. This may suggest that we can communicate, after all, our knowledge of a physiognomy, provided we are given adequate means for expressing ourselves. But the application of the police method does not change the fact that previous to it we did know more than we could tell at the time. Moreover, we can use the police method only by knowing how to match the features we remember with those in the collection, and we cannot tell how we do this. This very act of communication displays a knowledge that we cannot tell.

There are many other instances of the recognition of a characteristic physiognomy—some commonplace, others more technical—which have the same structure as the identification of a person. We recognize the moods of the human face, without being able to tell, except quite vaguely, by what signs we know it. At the universities great efforts are spent in practical classes to teach students to identify cases of diseases and specimens of rocks, of plants and animals. All descriptive sciences study physiognomies that cannot be fully described in words, nor even by pictures.

But can it not be argued, once more, that the possibility of teaching these appearances by practical exercises proves that we can tell our knowledge of them? The answer is that we can do so only by relying on the pupil's intelligent co-operation for catching the meaning of the demonstration. Indeed, any definition of a word denoting an external thing must ultimately rely on pointing at such a thing. This naming-cum-pointing is called "an ostensive

definition"; and this philosophic expression conceals a gap to be bridged by an intelligent effort on the part of the person to whom we want to tell what the word means. Our message had left something behind that we could not tell, and its reception must rely on it that the person addressed will discover that which we have not been able to communicate.

Gestalt psychology has demonstrated that we may know a physiognomy by integrating our awareness of its particulars without being able to identify these particulars, and my analysis of knowledge is closely linked to this discovery of Gestalt psychology. But I shall attend to aspects of Gestalt which have been hitherto neglected. Gestalt psychology has assumed that perception of a physiognomy takes place through the spontaneous equilibration of its particulars impressed on the retina or on the brain. However, I am looking at Gestalt, on the contrary, as the outcome of an active shaping of experience performed in the pursuit of knowledge. This shaping or integrating I hold to be the great and indispensable tacit power by which all knowledge is discovered and, once discovered, is held to be true.

The structure of Gestalt is then recast into a logic of tacit thought, and this changes the range and perspective of the whole subject. The highest forms of integration loom largest now. These are manifested in the tacit power of scientific and artistic genius. The art of the expert diagnostician may be listed next, as a somewhat impoverished form of discovery, and we may put in the same class the performance of skills, whether artistic, athletic, or technical. We have here examples of knowing, both

of a more intellectual and more practical kind; both the "*wissen*" and "*können*" of the Germans, or the "knowing what" and the "knowing how" of Gilbert Ryle. These two aspects of knowing have a similar structure and neither is ever present without the other. This is particularly clear in the art of diagnosing, which intimately combines skillful testing with expert observation. I shall always speak of "knowing," therefore, to cover both practical and theoretical knowledge. We can, accordingly, interpret the use of tools, of probes, and of pointers as further instances of the art of knowing, and may add to our list also the denotative use of language, as a kind of verbal pointing.

Perception, on which Gestalt psychology centered its attention, now appears as the most impoverished form of tacit knowing. As such it will be shown to form the bridge between the higher creative powers of man and the bodily processes which are prominent in the operations of perception.

Some recent psychological experiments have shown in isolation the principal mechanism by which knowledge is tacitly acquired. Many of you have heard of these experiments as revealing the diabolical machinery of hidden persuasion. Actually, they are but elementary demonstrations of the faculty by which we apprehend the relation between two events, both of which we know, but only one of which we can tell.

Following the example set by Lazarus and McCleary in 1949, psychologists call the exercise of this faculty a process of "subception."[1] These authors presented a person with a large number of nonsense syllables, and after showing certain of the syllables,

they administered an electric shock. Presently the person showed symptoms of anticipating the shock at the sight of "shock syllables"; yet, on questioning, he could not identify them. He had come to know when to expect a shock, but he could not tell what made him expect it. He had acquired a knowledge similar to that which we have when we know a person by signs which we cannot tell.

Another variant of this phenomenon was demonstrated by Eriksen and Kuethe in 1958.[2] They exposed a person to a shock whenever he happened to utter associations to certain "shock words." Presently, the person learned to forestall the shock by avoiding the utterance of such associations, but, on questioning, it appeared that he did not know he was doing this. Here the subject got to know a practical operation, but could not tell how he worked it. This kind of subception has the structure of a skill, for a skill combines elementary muscular acts which are not identifiable, according to relations that we cannot define.

These experiments show most clearly what is meant by saying that one can know more than one can tell. For the experimental arrangement wards off the suspicion of self-contradiction, which is not easy to dispel when anyone speaks of things he knows and cannot tell. This is prevented here by the division of roles between the subject and the observer. The experimenter observes that another person has a certain knowledge that he cannot tell, and so no one speaks of a knowledge he himself has and cannot tell.

We may carry forward, then, the following result. In both experiments that I have cited, subception

was induced by electric shock. In the first series the subject was shocked after being shown certain nonsense syllables, and he learned to expect this event. In the second series he learned to suppress the uttering of certain associations, which would evoke the shock. In both cases the shock-producing particulars remained tacit. The subject could not identify them, yet he relied on his awareness of them for anticipating the electric shock.

Here we see the basic structure of tacit knowing. It always involves two things, or two kinds of things. We may call them the two terms of tacit knowing. In the experiments the shock syllables and shock associations formed the first term, and the electric shock which followed them was the second term. After the subject had learned to connect these two terms, the sight of the shock syllables evoked the expectation of a shock and the utterance of the shock associations was suppressed in order to avoid shock. Why did this connection remain tacit? It would seem that this was due to the fact that the subject was riveting his attention on the electric shock. He was relying on his awareness of the shock-producing particulars only in their bearing on the electric shock. We may say that he learned to rely on his awareness of these particulars for the purpose of attending to the electric shock.

Here we have the basic definition of the logical relation between the first and second term of a tacit knowledge. It combines two kinds of knowing. We know the electric shock, forming the second term, by attending to it, and hence the subject is *specifiably* known. But we know the shock-producing particulars only by relying on our own awareness of

them for attending to something else, namely the electric shock, and hence our knowledge of them remains *tacit*. This is how we come to know these particulars, without becoming able to identify them. Such is the *functional relation* between the two terms of tacit knowing: *we know the first term only by relying on our awareness of it for attending to the second.*

In his book on freedom of the will, Austin Farrar has spoken at one point of *disattending from* certain things for attending *to* others. I shall adopt a variant of this usage by saying that in an act of tacit knowing we *attend from* something for attending *to* something else; namely, *from* the first term *to* the second term of the tacit relation. In many ways the first term of this relation will prove to be nearer to us, the second further away from us. Using the language of anatomy, we may call the first term *proximal*, and the second term *distal*. It is the proximal term, then, of which we have a knowledge that we may not be able to tell.

In the case of a human physiognomy, I would now say that we rely on our awareness of its features for attending to the characteristic appearance of a face. We are attending *from* the features *to* the face, and thus may be unable to specify the features. And I would say, likewise, that we are relying on our awareness of a combination of muscular acts for attending to the performance of a skill. We are attending *from* these elementary movements *to* the achievement of their joint purpose, and hence are usually unable to specify these elementary acts. We may call this the *functional structure* of tacit knowing.

But we may ask: does not the *appearance* of the experimental setting—composed of the nonsense syllables and the electric shocks—undergo some change when we learn to anticipate a shock at the sight of certain syllables? It does, and in a very subtle way. The expectation of a shock, which at first had been vague and unceasing, now becomes sharply fluctuating; it suddenly rises at some moments and drops between them. So we may say that even though we do not learn to recognize the shock syllables as distinct from other syllables, we do become aware of facing a shock syllable in terms of the apprehension it evokes in us. In other words, we are aware of seeing these syllables in terms of that on which we are focusing our attention, which is the probability of an electric shock. Applying this to the case of a physiognomy, we may say that we are aware of its features in terms of the physiognomy to which we are attending. In the exercise of a skill, we are aware of its several muscular moves in terms of the performance to which our attention is directed. We may say, in general, that we are aware of the proximal term of an act of tacit knowing in the appearance of its distal term; we are aware of that *from* which we are attending *to* another thing, in the *appearance* of that thing. We may call this the *phenomenal structure* of tacit knowing.

But there is a significance in the relation of the two terms of tacit knowing which combines its functional and phenomenal aspects. When the sight of certain syllables makes us expect an electric shock, we may say that they *signify* the approach of a shock. This is their *meaning* to us. We could

say, therefore, that when shock syllables arouse an apprehension in us, without our being able to identify the syllables which arouse it, we know these syllables only in terms of their meaning. It is their meaning to which our attention is directed. It is in terms of their meaning that they enter into the appearance of that *to* which we are attending *from* them.

We could say, in this sense, that a characteristic physiognomy is the meaning of its features; which is, in fact, what we do say when a physiognomy expresses a particular mood. To identify a physiognomy would then amount to relying on our awareness of its features for attending to their joint meaning. This may sound far-fetched, because the meaning of the features is observed at the same spot where the features are situated, and hence it is difficult to separate mentally the features from their meaning. Yet, the fact remains that the two are distinct, since we may know a physiognomy without being able to specify its particulars.

To see more clearly the separation of a meaning from that which has this meaning, we may take the example of the use of a probe to explore a cavern, or the way a blind man feels his way by tapping with a stick. For here the separation of the two is wide, and we can also observe here the process by which this separation gradually takes place. Anyone using a probe for the first time will feel its impact against his fingers and palm. But as we learn to use a probe, or to use a stick for feeling our way, our awareness of its impact on our hand is transformed into a sense of its point touching the objects we are exploring. This is how an interpretative effort

transposes meaningless feelings into meaningful ones, and places these at some distance from the original feeling. We become aware of the feelings in our hand in terms of their meaning located at the tip of the probe or stick to which we are attending. This is so also when we use a tool. We are attending to the meaning of its impact on our hands in terms of its effect on the things to which we are applying it. We may call this the *semantic aspect* of tacit knowing. All meaning tends to be displaced *away from ourselves*, and that is in fact my justification for using the terms "proximal" and "distal" to describe the first and second terms of tacit knowing.

From the three aspects of tacit knowing that I have defined so far—the functional, the phenomenal, and the semantic—we can deduce a fourth aspect, which tells us what tacit knowing is a knowledge of. This will represent its *ontological* aspect. Since tacit knowing establishes a meaningful relation between two terms, we may identify it with the *understanding* of the comprehensive entity which these two terms jointly constitute. Thus the proximal term represents the *particulars* of this entity, and we can say, accordingly, that we comprehend the entity by relying on our awareness of its particulars for attending to their joint meaning.

This analysis can be applied with interesting results to the case of visual perception. Physiologists long ago established that the way we see an object is determined by our awareness of certain efforts inside our body, efforts which we cannot feel in themselves. We are aware of these things going on inside our body in terms of the position, size, shape, and motion of an object, to which we are attending.

In other words we are attending *from* these internal processes *to* the qualities of things outside. These qualities are what those internal processes *mean* to us. The transposition of bodily experiences into the perception of things outside may now appear, therefore, as an instance of the transposition of meaning away from us, which we have found to be present to some extent in all tacit knowing.

But it may be said that the feelings transposed by perception differ from those transposed by the use of tools or probes, by being hardly noticeable in themselves previous to their transposition. An answer to this—or at least part of an answer to it—is to be found in experiments extending subception to subliminal stimuli. Hefferline and collaborators have observed that when spontaneous muscular twitches, unfelt by the subject—but observable externally by a million-fold amplification of their action currents—were followed by the cessation of an unpleasant noise, the subject responded by increasing the frequency of the twitches and thus silencing the noise much of the time.[3] Tacit knowing is seen to operate here on an internal action that we are quite incapable of controlling or even feeling in itself. We become aware of our operation of it only in the silencing of a noise. This experimental result seems closely analogous to the process by which we become aware of subliminal processes inside our body in the perception of objects outside.

This view of perception, that it is an instance of the transposition of feelings which we found in the use of probes and in the process of subception, is borne out by the fact that the capacity to see external objects must be acquired, like the use of

probes and the feats of subception, by a process of learning which can be laborious.

Modern philosophers have argued that perception does not involve projection, since we are not previously aware of the internal processes which we are supposed to have projected into the qualities of things perceived. But we have now established that projection of this very kind is present in various instances of tacit knowing. Moreover, the fact that we do not originally sense the internal processes in themselves now appears irrelevant. We may venture, therefore, to extend the scope of tacit knowing to include neural traces in the cortex of the nervous system. This would place events going on inside our brain on the same footing as the subliminal twitches operated by Hefferline's subjects.*

This brings us to the point at which I hinted when I first mentioned perception as an instance of tacit knowing. I said that by elucidating the way our bodily processes participate in our perceptions we will throw light on the bodily roots of all thought, including man's highest creative powers. Let me show this now.

Our body is the ultimate instrument of all our external knowledge, whether intellectual or practical. In all our waking moments we are *relying* on

* Such a hypothesis does not explain how perceived sights, or any other state of consciousness, arise in conjunction with neural processes. It merely applies the principle that wherever some process in our body gives rise to consciousness in us, our tacit knowing of the process will make sense of it in terms of an experience to which we are attending.

our awareness of contacts of our body with things outside for *attending* to these things. Our own body is the only thing in the world which we normally never experience as an object, but experience always in terms of the world to which we are attending from our body. It is by making this intelligent use of our body that we feel it to be our body, and not a thing outside.

I have described how we learn to feel the end of a tool or a probe hitting things outside. We may regard this as the transformation of the tool or probe into a sentient extension of our body, as Samuel Butler has said. But our awareness of our body for attending to things outside it suggests a wider generalization of the feeling we have of our body. Whenever we use certain things for attending *from* them to other things, in the way in which we always use our own body, these things change their appearance. They appear to us now in terms of the entities to which we are attending *from* them, just as we feel our own body in terms of the things outside to which we are attending *from* our body. In this sense we can say that when we make a thing function as the proximal term of tacit knowing, we incorporate it in our body—or extend our body to include it—so that we come to dwell in it.

The full range of this generalization can only be hinted at here. Indications of its scope may be seen by recalling that, at the turn of the last century, German thinkers postulated that indwelling, or empathy, is the proper means of knowing man and the humanities. I am referring particularly to Dilthey[4] and Lipps.[5] Dilthey taught that the mind of a person can be understood only by reliving its workings;

and Lipps represented aesthetic appreciation as an entering into a work of art and thus dwelling in the mind of its creator. I think that Dilthey and Lipps described here a striking form of tacit knowing as applied to the understanding of man and of works of art, and that they were right in saying that this could be achieved only by indwelling. But my analysis of tacit knowing shows that they were mistaken in asserting that this sharply distinguished the humanities from the natural sciences. Indwelling, as derived from the structure of tacit knowing, is a far more precisely defined act than is empathy, and it underlies all observations, including all those described previously as indwelling.

We meet with another indication of the wide functions of indwelling when we find acceptance to moral teachings described as their *interiorization*. To interiorize is to identify ourselves with the teachings in question, by making them function as the proximal term of a tacit moral knowledge, as applied in practice. This establishes the tacit framework for our moral acts and judgments. And we can trace this kind of indwelling to logically similar acts in the practice of science. To rely on a theory for understanding nature is to interiorize it. For we are attending from the theory to things seen in its light, and are aware of the theory, while thus using it, in terms of the spectacle that it serves to explain. This is why mathematical theory can be learned only by practicing its application: its true knowledge lies in our ability to use it.

The identification of tacit knowing with indwelling involves a shift of emphasis in our conception of tacit knowing. We had envisaged tacit knowing

in the first place as a way to know more than we can tell. We identified the two terms of tacit knowing, the proximal and the distal, and recognized the way we attend *from* the first *to* the second, thus achieving an integration of particulars to a coherent entity to which we are attending. Since we were not attending to the particulars in themselves, we could not identify them: but if we now regard the integration of particulars as an interiorization, it takes on a more positive character. It now becomes a means of making certain things function as the proximal terms of tacit knowing, so that instead of observing them in themselves, we may be aware of them in their bearing on the comprehensive entity which they constitute. It brings home to us that it is not by looking at things, but by dwelling in them, that we understand their joint meaning.

We can see now how an unbridled lucidity can destroy our understanding of complex matters. Scrutinize closely the particulars of a comprehensive entity and their meaning is effaced, our conception of the entity is destroyed. Such cases are well known. Repeat a word several times, attending carefully to the motion of your tongue and lips, and to the sound you make, and soon the word will sound hollow and eventually lose its meaning. By concentrating attention on his fingers, a pianist can temporarily paralyze his movement. We can make ourselves lose sight of a pattern or physiognomy by examining its several parts under sufficient magnification.

Admittedly, the destruction can be made good by interiorizing the particulars once more. The word uttered again in its proper context, the pianist's

fingers used again with his mind on his music, the features of a physiognomy and the details of a pattern glanced at once more from a distance: they all come to life and recover their meaning and their comprehensive relationship.

But it is important to note that this recovery never brings back the original meaning. It may improve on it. Motion studies, which tend to paralyze a skill, will improve it when followed by practice. The meticulous dismembering of a text, which can kill its appreciation, can also supply material for a much deeper understanding of it. In these cases, the detailing of particulars, which by itself would destroy meaning, serves as a guide to their subsequent integration and thus establishes a more secure and more accurate meaning of them.

But the damage done by the specification of particulars may be irremediable. Meticulous detailing may obscure beyond recall a subject like history, literature, or philosophy. Speaking more generally, the belief that, since particulars are more tangible, their knowledge offers a true conception of things is fundamentally mistaken.

Of course, tacit reintegration of particulars is not the only way to recover their meaning, destroyed by focusing our attention on them. The destructive analysis of a comprehensive entity can be counteracted in many cases by explicitly stating the relation between its particulars. Where such explicit integration is feasible, it goes far beyond the range of tacit integration. Take the case of a machine. One can learn to use it skillfully, without knowing exactly how it works. But the engineer's understanding of its construction and operation goes much deeper.

We possess a practical knowledge of our own body, but the physiologist's theoretical knowledge of it is far more revealing. The formal rules of prosody may deepen our understanding of so delicate a thing as a poem.

But my examples show clearly that, in general, an explicit integration cannot replace its tacit counterpart. The skill of a driver cannot be replaced by a thorough schooling in the theory of the motorcar; the knowledge I have of my own body differs altogether from the knowledge of its physiology; and the rules of rhyming and prosody do not tell me what a poem told me, without any knowledge of its rules.

We are approaching here a crucial question. The declared aim of modern science is to establish a strictly detached, objective knowledge. Any falling short of this ideal is accepted only as a temporary imperfection, which we must aim at eliminating. But suppose that tacit thought forms an indispensable part of all knowledge, then the ideal of eliminating all personal elements of knowledge would, in effect, aim at the destruction of all knowledge. The ideal of exact science would turn out to be fundamentally misleading and possibly a source of devastating fallacies.

I think I can show that the process of formalizing all knowledge to the exclusion of any tacit knowing is self-defeating. For, in order that we may formalize the relations that constitute a comprehensive entity, for example, the relations that constitute a frog, this entity, i.e., the frog, must be first identified informally by tacit knowing; and, indeed, the meaning of a mathematical theory of the frog lies in its

continued bearing on this still tacitly known frog. Moreover, the act of bringing a mathematical theory to bear on its subject is itself a tacit integration of the kind we have recognized in the use of a denotative word for designating its object. And we have seen also that a true knowledge of a theory can be established only after it has been interiorized and extensively used to interpret experience. Therefore: a mathematical theory can be constructed only by relying on *prior* tacit knowing and can function as a theory only *within* an act of tacit knowing, which consists in our attending *from* it to the previously established experience on which it bears. Thus the ideal of a comprehensive mathematical theory of experience which would eliminate all tacit knowing is proved to be self-contradictory and logically unsound.

But I must not rest my case on such an abstract argument. Let me finish this lecture, therefore, by presenting you with a most striking concrete example of an experience that cannot possibly be represented by any exact theory. It is an experience within science itself: the experience of seeing a problem, as a scientist sees it in his pursuit of discovery.

It is a commonplace that all research must start from a problem. Research can be successful only if the problem is good; it can be original only if the problem is original. But how can one see a problem, any problem, let alone a good and original problem? For to see a problem is to see something that is hidden. It is to have an intimation of the coherence of hitherto not comprehended particulars. The problem is good if this intimation is true; it is original if

no one else can see the possibilities of the comprehension that we are anticipating. To see a problem that will lead to a great discovery is not just to see something hidden, but to see something of which the rest of humanity cannot have even an inkling. All this is a commonplace; we take it for granted, without noticing the clash of self-contradiction entailed in it. Yet Plato has pointed out this contradiction in the *Meno*. He says that to search for the solution of a problem is an absurdity; for either you know what you are looking for, and then there is no problem; or you do not know what you are looking for, and then you cannot expect to find anything.

The solution which Plato offered for this paradox was that all discovery is a remembering of past lives. This explanation has hardly ever been accepted, but neither has any other solution been offered for avoiding the contradiction. So we are faced with the fact that, for two thousand years and more, humanity has progressed through the efforts of people solving difficult problems, while all the time it could be shown that to do this was either meaningless or impossible. We have here the classical case of Poe's *Purloined Letter*, of the momentous document lying casually in front of everybody, and hence overlooked by all. For the *Meno* shows conclusively that if all knowledge is explicit, i.e., capable of being clearly stated, then we cannot know a problem or look for its solution. And the *Meno* also shows, therefore, that if problems nevertheless exist, and discoveries can be made by solving them, we can know things, and important things, that we cannot tell.

The kind of tacit knowledge that solves the paradox of the *Meno* consists in the intimation of some-

thing hidden, which we may yet discover. There exists another important manifestation of these mental powers. We are often told that great scientific discoveries are marked by their fruitfulness; and this is true. But how can we recognize truth by its fruitfulness? Can we recognize that a statement is true by appreciating the wealth of its yet undiscovered consequences? This would of course be nonsensical, if we had to know explicitly what was yet undiscovered. But it makes sense if we admit that we can have a tacit foreknowledge of yet undiscovered things. This is indeed the kind of foreknowledge the Copernicans must have meant to affirm when they passionately maintained, against heavy pressure, during one hundred and forty years before Newton proved the point, that the heliocentric theory was not merely a convenient way of computing the paths of planets, but was really true.

It appears, then, that to know that a statement is true is to know more than we can tell and that hence, when a discovery solves a problem, it is itself fraught with further intimations of an indeterminate range, and that furthermore, when we accept the discovery as true, we commit ourselves to a belief in all these as yet undisclosed, perhaps as yet unthinkable, consequences.

Since we have no explicit knowledge of these unknown things, there can also be no explicit justification of a scientific truth. But as we can know a problem, and feel sure that it is pointing to something hidden behind it, we can be aware also of the hidden implications of a scientific discovery, and feel confident that they will prove right. We feel sure of this, because in contemplating the discovery

we are looking at it not only in itself but, more significantly, as a clue to a reality of which it is a manifestation. The pursuit of discovery is conducted from the start in these terms; all the time we are guided by sensing the presence of a hidden reality toward which our clues are pointing; and the discovery which terminates and satisfies this pursuit is still sustained by the same vision. It claims to have made contact with reality: a reality which, being real, may yet reveal itself to future eyes in an indefinite range of unexpected manifestations.

We have here reached our main conclusions. Tacit knowing is shown to account (1) for a valid knowledge of a problem, (2) for the scientist's capacity to pursue it, guided by his sense of approaching its solution, and (3) for a valid anticipation of the yet indeterminate implications of the discovery arrived at in the end.

Such indeterminate commitments are necessarily involved in any act of knowing based on indwelling. For such an act relies on interiorizing particulars to which we are not attending and which, therefore, we may not be able to specify, and relies further on our attending from these unspecifiable particulars to a comprehensive entity connecting them in a way we cannot define. This kind of knowing solves the paradox of the *Meno* by making it possible for us to know something so indeterminate as a problem or a hunch, but when the use of this faculty turns out to be an indispensable element of all knowing, we are forced to conclude that all knowledge is of the same kind as the knowledge of a problem.

This is in fact our result. We must conclude that

the paradigmatic case of scientific knowledge, in which all the faculties that are necessary for finding and holding scientific knowledge are fully developed, is the knowledge of an approaching discovery.

To hold such knowledge is an act deeply committed to the conviction that there is something there to be discovered. It is personal, in the sense of involving the personality of him who holds it, and also in the sense of being, as a rule, solitary; but there is no trace in it of self-indulgence. The discoverer is filled with a compelling sense of responsibility for the pursuit of a hidden truth, which demands his services for revealing it. His act of knowing exercises a personal judgment in relating evidence to an external reality, an aspect of which he is seeking to apprehend.

The anticipation of discovery, like discovery itself, may turn out to be a delusion. But it is futile to seek for strictly impersonal criteria of its validity, as positivistic philosophies of science have been trying to do for the past eighty years or so. To accept the pursuit of science as a reasonable and successful enterprise is to share the kind of commitments on which scientists enter by undertaking this enterprise. You cannot formalize the act of commitment, for you cannot express your commitment non-committally. To attempt this is to exercise the kind of lucidity which destroys its subject matter. Hence the failure of the positivist movement in the philosophy of science. The difficulty is to find a stable alternative to its ideal of objectivity. This is indeed the task for which the theory of tacit knowing should prepare us.

Papers by the author on which this book has drawn or in which its ideas are developed further:

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"The Two Cultures," *Encounter* (September 1959).
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