

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.