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Lecture 2

The Structure of Tacit Knowing.

by Michael Polanyi

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In my last talk I alluded to the powers of the mind by which we establish coherence in nature: a coherence which reveals the presence of something real in nature. I said that coherence is often automatically recognised by our eyes and ears, but that such deeply hidden coherence as natural science seeks to discover, is grasped only by a creative act of the imagination. I have said that there is no strict rule by which to distinguish a true coherence that has an important meaning, from an accidental coherence that means nothing.

Tonight I want to tell you of these mental powers, which operating without strict rules, enable us to pursue scientific enquiries and to establish their result to be true. I shall speak of these faculties in broad terms tonight, in the hope of explaining in a week's time in greater detail how they actually carry out the task of scientific discovery.

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When I point my finger at the wall and call out: 'Look at this!' all eyes turn to the wall, away from my finger. You are clearly attending to my pointing finger, but only in order to look at something else, namely at the point to which my finger is directing your attention. We have here two different ways of being aware of things. One way is to look at a thing. This is the way you look at the wall. But how is one to describe the way you see my finger

pointing at the wall? You are not looking at my finger, but away from it. I should say that you do not see it as a mere object, to be examined as such, but as an object having a function, the function of directing your attention away from itself and at something else. But this is not to say that my pointing finger was trying to make you disregard itself. Far from it. It wanted to be seen, but to be seen only in order to be followed and not in order to be examined.

I shall call my pointing finger a subsidiary thing or an instrumental thing that functions by pointing at an object which is at the focus of our attention. And I suggest that we have here two different kinds of awareness. We are subsidiarily aware of the pointing finger and focally aware of the object that it points at. We establish an integrated relationship between them by recognising the direction in which the finger directs us and by following this direction.

This relationship is not symmetrical. The finger points at the wall, but the wall does not point at the finger. The relationship that we have established has an intrinsic direction, it is directive. Thus the finger has a meaning that the wall lacks. It can raise a problem; if you come across a pointing finger by itself in a wood, it makes you wonder what it may be pointing at. This shows that it is for us to establish the coherence of the pointing finger with that which it points at. It is for us to comprehend the coherent system connecting a subsidiary element with the focal point on which the subsidiary element bears. And note that we perform this comprehending without a word. No syllogism is set up, no evidence is cited. The performance is tacit, and since its result is valid, we may call it an act of tacit inference.

Another case of this kind - to be found at the bottom of the table - will reinforce this analysis and develope it further. Think of a pair of stereoscopic photographs, viewed in the proper way, one eye looking at one, the other eye at the other. The objects shown in the two pictures appear in their joint image as distributed in depth, hard and tangible. This is what we see at the focus of our eyes, but it involves also the sight of the two component pictures: cover these up and we see nothing at all. But we do not see these two pictures in themselves. In a way we look through them or from them to their joint image. So I shall class our awareness of them as subsidiary and observe that the way we look at them integrates their sights into the spacially deepened image to which they contribute. Thanks to our integration the two flat pictures effectively function as clues to a spacial image.

We may say that this image is their joint meaning and that this joint meaning lies in the focus of our attention. So far the structure of this tacit integration is analogous to that of a finger pointing at an object. But something important is added here. The joint meaning of the subsidiaries is expressed in a new sensory quality. Sights in depth have come about by integrating sights that were comparatively flat.

This change of appearance is in fact a regular accompaniment of tacit integration. A pointing finger also looks a little different than the finger fixed in the same position by arthritis. This kind of difference is more noticeable in the closely analogous case of a word denoting an object. The word when functioning in this way appears transparent, by contrast to its opaque appearance, when we listen to it as a sequence of sounds. I shall come back to

this later. The functions of the subsidiaries, which brings out their joint meaning, will be seen usually expressed in a novel appearance.

Professor Hadley Cantril of Princeton has shown that when we introduce two fairly disparate pictures into the stereoscope, we see fanciful integrations of them. Such images are illusory. But we may limit ourselves to the case that the two pictures viewed are proper photographs and that hence their stereoscoping image is a reasonably correct evaluation of their joint meaning. We can then regard stereoscopic viewing as a feat of tacit inference in analogy to a process of explicit inference.

But let me stop to warn here from a misconception. It is a mistake to identify subsidiary awareness with sub-conscious or pre-conscious awareness, or with the fringe of consciousness described by William James. The relation of subsidiaries to that on which they bear is a logical relation similar to that which a premiss has to the inference drawn from it, with the great difference, that the inferences arrived at here are tacit. Subsidiary awareness can be fully conscious, as that of a pointing finger or a pair of pictures viewed in the stereoscope, though in other cases our consciousness of subsidiaries may be on a very low level and may be altogether subliminal. As we touch upon the several examples in the table we shall meet with every level of consciousness among the subsidiaries. These variations in their level of consciousness in no way affect their functions as subsidiary elements of an act of tacit knowing.

Jean Piaget has strikingly contrasted the act of acquiring knowledge by a sensory act like perception as compared with a process of explicit inference. He points out that explicit inference, is

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Tacit Knowing:

From subsidiaries	by integrating them	we focus at
finger	pointing at	an object
name	designating	a person
features	forming	a physiognomy
motions	combined to	skilled action
probe	exploring	a cavity
sensory clues	combined to	a percept
factual clues	leading to	a discovery
stereo pictures	viewed as	a stereo image

reversible in the sense that we can go back to its premisses and go forward again to its conclusions, as often as we like, while this is not true for the sensory act. And since perception is always combined with action and action with sensation, Piaget contrasts all sensorimotor acts with explicit inferences and calls them irreversible

All acts of tacit integration are irreversible, and this can be understood from the structure of tacit knowing. We find indeed that tacit knowing can have two kinds of irreversibility. One consists in the fact that we may not be able to identify all the clues which we have integrated in establishing their joint meaning. The other kind of irreversibility goes beyond this. It is due to the fact that when we shift the focus of our attention from the meaningful result of tacit integration, and focus on the subsidiaries, their integration is wiped out. The subsidiary particulars cease to have a bearing on their prospective target and are reduced to an aggregate of meaningless objects. The first kind of irreversibility can be

contingent, by contrast to the second, that is logically necessary.

The joint viewing of two stereoscopic photographs offers a simple example both of contingent and logical irreversibility. Think of the differences in the two pictures, by virtue of which their joint viewing offers the sight of spacial depth: these differences are very small and are scattered all over the pictures. It is almost impossible to identify them, they are virtually unspecifiable. This is the first kind of irreversibility. But even if we could overcome this and identify the clues of stereoscopic vision it would not be the same as retracing the steps of a mathematical proof. To reconsider a mathematical deduction, is to deepen our understanding of the idea which it embodies. We can see now in the premises the whole panorama of their implications. By contrast, if we take out the stereo pictures from the viewer and look at them separately, the cease to tell us anything of what they jointly mean, we see nothing of what they would jointly present to our eyes. To go back to the antecedents of our tacit inference, has not deepened our grasp of its result, but has made us lose sight of it. You can verify this in all the instances of tacit knowing listed in the table.

I have mentioned already in passing the most widely known example of this disintegration of meaning, caused by the shifting of our focal attention to that which has this meaning. A spoken word loses its meaning if we repeat it a number of times, while carefully attending to the movement of our lips and tongue and to the sound we are making. These actions were meaningful, so long as we attended to that on which they jointly bear and lost their meaning when we shifted our attention to them. It is also well known

that we tend to lose control of the motions forming a skilful performance, if we attend to them closely. The famous tight-rope walker, Blondin, says in his memoirs that he would instantly lose his balance if he thought directly of keeping it; he must force himself to think only of the way he would eventually descend from the rope.

Admittedly, the disintegration of tacit knowledge by shifting our attention to its clues is not irreparable. The two stereo pictures can be viewed once more jointly; the word that lost its meaning will regain it if we once more use it, once more subsidiarly be casting our mind forward to something we can say by it. The paralysis of a skill, due to switching our attention to the motions that compose its performance, can be remedied by attending once more to the purpose which our co-ordinated motions are to serve.

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 paralyse 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. In his essay on the Name and Nature of Poetry A. E. Housman has described the disastrous effect of spelling out in detail the allusions of Edgar Poe

in his poem The Haunted Palace.* My former colleague at Manchester the distinguished French scholar Mansell Jones has written that the humanities are discredited and rejected because of their unconscious abuse of erudation in the teaching of humane subjects. "Research - he wrote - is at once the flower and the virus of Arts."** But it is not the unintentional damage done to our tacit knowledge, by reducing our capacity to re-integrate its subsidiaries after having brought them to the light of focal consciousness, that is the main issue here; it is a deliberate refusal to rely on the tacit mode of integration. The modern mind refuses to accept the necessity for tacit assumptions and wants to keep the grounds of its beliefs clearly in focus, as one does in an explicit deduction. Our whole culture is pervaded by the resolve to avoid unspecifiable commitments and to get down ruthlessly to the hard facts of this world and to keep our eyes firmly fixed on them.

This is true above all for science. It was science that originated this spirit of ruthless enquiry and in the twentieth century science itself was subjected to this enquiry, demanding strict methods of research and, above all, strict criteria of meaning and truth in science. Science shall remain my main example for the

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* "The Haunted Palace is one of Poe's best poems so long as we are content to swim in the sensations it evokes and only vaguely to apprehend the allegory. We are roused to discomfort, at least I am, when we begin to perceive how exact in detail the allegory is; when it dawns upon us that the fair palace door is Roderick Usher's mouth, the pearl and ruby his teeth and lips, the yellow banners his hair, the ramparts plumed and pallid his forehead, and when we are reduced to hoping, for it is no more than a hope, that the winged odours have no connexion with hair-oil." A. E. Housman, The Name and Nature of Poetry (New York, Macmillan Co. and Cambridge, England, at the University Press, 1933) p. 36.

** P. Mansell Jones, Modern Humanities in the Technological Age with Reference to the Study of French, Manchester University Press, 1957.

working of tacit knowledge by contrast to these demands of strict criteria of scientific procedure.

The conception of science as a precise relationship of facts open to public inspection implies that facts are definite and specifiable, that they are neither more nor less than what their designation tells. This I shall contest. Last time I have shown that true science bears on reality and, in doing so, carries with it the expectation of yet unknown future implications; now I shall amplify the conception of scientific truth at the other end: not in its anticipations, but in its foundations. We shall find that at the source of his knowledge too, the scientist knows far more than he can tell.

There is an entry in my table which speaks of features forming a physiognomy. These subsidiary items seem even more difficult to identify than were the subsidiaries in the pair of stereophotographs. Shall we take it that we can actually know-that is, know subsidarily - far more than we can tell? Let us look into this.

It is a fact that we can know a person's face and recognise him among a thousand, indeed among a million, yet usually cannot tell how we recognise a face we know. And we have many other instances of the recognition of a characteristic appearance in science itself, which have the same structure as the identification of a person. At the universities great efforts are spent in practical classes to teach students to identify cases of diseases and specimens of rocks, plants and animals. All descriptive sciences study such physiognomies which cannot be fully described in words, nor even by pictures. All this practical teaching must rely on the intelligent pupil's capacity to recognise the relevant particulars of a physiognomy and their characteristic relationship in the physiognomy. It

relies also on it that he acquires a skill in testing, which entails a combination of motions which will remain unspecifiable.

But can it not be argued that the possibility of teaching the recognition of characteristic appearances proves that we can tell what we know of them? No, what the pupil must discover for himself by trial and error is - even though he be guided by our advice and example - something we could not tell him.

The way this happens will become clearer from some fairly recent work in experimental psychology, which has developed a method for studying the elementary act on which all tacit knowing is based. I am referring to the phenomenon called subception, which was first definitely observed and named subception by Lazarus and McCleary in 1949. They presented a subject a large number of nonsense syllables, and after showing him certain of the syllables, they administered an electric shock to him. Presently the subject 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 Erikson and Kuethe in 1956. They exposed a person to shock whenever he happened to utter associations to certain 'shock words'. Soon 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 invented 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.

The analysis of subception wards off the suspicion of self-contradiction, which may arise in other cases when anyone speaks of things he himself both knows and cannot tell. Subception divides these two functions, so that one person observes that another person has a knowledge that he cannot tell. No one speaks then of a knowledge that he himself has and cannot tell.

We can sum up so far as follows. In two experiments, subception was induced by electric shock. In the first series, the subject was shocked after being presented with certain nonsense syllables, and he learnt to expect the shock. In the second series he learnt to suppress the uttering of certain associations which would evoke the shock. In both cases the knowledge of the shock-producing particulars remained unidentifiable, yet the subject relied on his awareness of them for anticipating the shock. He had acquired a subsidiary awareness of these particulars while attending focally to the expectation of a shock; the particulars had become the subsidiary term of a tacit knowledge of which the expectation of the shock was the focal term.

The conclusions of Lazarus and McCleary have been contested but eventually confirmed by its very critic. Many further experiments have lent support to the effectiveness of this kind of subception.

Moreover, a new variant of subception, described by Hefferline in 1959, extended experimental tacit knowing to subliminal stimuli: Hefferline observed that when spontaneous muscular twitches, unfelt by the subject - but observable by a million-fold amplification of their action currents - were followed by the brief cessation of an unpleasant noise, the subject responded by increasing the frequency of the twitches and thus silencing the noise more frequently.

Experiments carried out during the past decade in Soviet Russia have shown this phenomenon in a different manner (Razran 1961). When an internal stimulus which the subject cannot notice in itself - such as the injection of a stream of acidified water in the intestinal canal - is repeatedly followed by a punishment, the internal stimulus will come to arouse an expectation of the punishment.

More recently, Hefferline produced a new variant of his experiments on subliminal twitches. He succeeded in training subjects to press a lever every time a spontaneous twitch occurred in their selected muscle. They had of course no idea what it was they were responding to.

It is to this type of experiments I was referring, when I said at the beginning, that the subsidiary elements of tacit knowing can be on any level of consciousness, from a fully conscious level, down to one far below our powers of apprehension.

Remember also that the focal experience arrived at by tacit inference, tells us the meaning of the subsidiaries in terms of a sensation that was not present before. A subliminal event integrated to a focal act or to a focal stimulus produces a maximum degree of phenomenal change. Things that cannot be experienced in themselves at all act as instruments of conscious performances or else they stimulate conscious actions without being noticed in themselves.

There is another point to take up on this occasion. Right at the start, when I pointed at the wall and you looked at it, you integrated the sight of my pointing finger to that which I was pointing at. It is difficult to say where the focal experience, namely the wall with the finger pointing at it, was eventually

situated. The stereoscopic viewing of two photographs produced a joint picture of them which was certainly not at the place where the pictures were. In other cases, as in the integration of muscular motions to the performance of a skill, or the integration of features to a physiognomy, the result may be thought to lie about at the same place where the subsidiaries are situated. The Hefferline type of experiments produce integrated events not easily localisable, but certainly not located at the place inside the body where the subsidiaries are happening.

But there can occur a more definite displacement of feelings from where the subsidiaries are first noticed, a displacement which corresponds to a meaningful integration of them. We find this in the way we learn to use a probe for exploring a cavity, or in the way a blind man feels his way by tapping around with a stick. When using a probe for the first time we feel its impact against our 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. Thus our integrative effort transposes our meaningless feelings into meaningful ones, and places these at some distance from the original feelings. We become aware of the feelings in our hand in terms of their meaning located at the far end of the probe or stick, to which we are attending. This happens also when we learn to use a tool. We attend to the meaning of its impact on our hands in terms of its effects on the things to which we are applying it and thus make these effects increasingly meaningful.

It should be clear by now how profoundly the act of tacit integration differs from a process of explicit deduction. To go back

to the grounds on which a tacit integration rests, we have not only to contend with its logical irreversibility which blots out the sight of the integrated conclusions the moment we direct our attention to its premises, but - as we have seen - many of these premises may not only be difficult to identify, but be actually not observable in themselves at all. We are far away from the precisely defined and publicly visible evidence required by the ideal of the exact sciences, and indeed from any acknowledged standards of empirical evidence. Moreover when we watch how tacit knowing operates on its antecedents, the difference from explicit inference becomes even more marked. The clues are subjected to an integration which can be carried out only by a private mental act. It is only through our own eyes that the sight of two stereo pictures can be transformed into the spacial sight of their content. No manipulation of symbols can perform this act, its quality must be seen to be known. For an integration that yields a meaning links together two kinds of awareness, the subsidiary and the focal, while by contrast, symbols used in an explicit inference can all be put down on a blackboard and be seen there focally by the same kind of awareness. Meaning must therefore be experienced as a sensory quality.

Finally, the meaning we arrive at may be something as unsubstantial as the stereoscopic image, or an undefinable human physiognomy, in which we recognise the emotional, intellectual and moral capabilities of a human mind.

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We are now ready to take up our central purpose, which is to discern the powers by which we recognise coherence in nature, I have to describe now the act of perception more completely. For

many years I have pursued the idea that the principles of scientific knowledge and discovery are to be found in the mechanism of perception, so I have to describe now the act of perception in the terms of tacit knowing and then generalise the result to the process of scientific discovery.

Suppose I look at my right hand. I recognise its area by its closed contours, but if that were all, my hand, when moved about, would keep changing its colour, its shape and its size. The experience of my hand as a solid object, having definite properties, would never asrise. I see it as such, by integration of a host of rapidly changing clues, both in the field of vision and inside my eyes and some still deeper in my body. My powers of recognising coherence maked me see these thousand changing clues jointly, as one single unchanging object moving about at different distances, viewed from different angles, under variable illuminations. A successful integration of innumerable rapidly changing particulars into a single constant sight, makes us recognise that we have a real object before us.

It is interesting to note here the stages between things patently real to other things of a more or less dubious reality. Look at a finger of your hand through a pinhole in a sheet of paper, or better still, through a blackened tube, and then move your finger back and forth. You will see it swelling as it approaches your eye and shrinking again when moved away. Psychologists have called this effect a "de-realisation." The moving object has lost its constant size, for some important clues to its constancy coming from the corner of our eyes have been cut off by the blackened tube. We can say that its coherence having been impoverished, the object's reality has become dubious.

Taking this little experiment into account, we can note that the integration carried out by our eyes in looking at something, comprises clues at three levels of consciousness. There are the things straight in front of us, seen quite consciously then there are many things seen at the edge of the visual field, which we take in without hardly noticing them, and thirdly there are a great many internal clues, like the contraction of our eye muscles or the changing situation in the cavity of the internal ear, which we cannot feel in themselves at all. All these experiences function jointly in seeing an object. The way I see my hand moving about in front of me, the distance at which I see it, the shape I see it having, its colour and texture, the speed and direction of its motion, all its sensory qualities, are determined by clues--whether manifest or marginal, or deeply hidden and subliminal--which are integrated into its appearance. <u>The appearance of the object, persistent and real, is the joint meaning of all these subsidiaries</u>.

Before passing on from here to the case of scientific knowledge and scientific discovery, I want to mention one more characteristic of tacit integration to which Conrad Lorenz has called attention. It is speed of such integration. Would we have to note one by one the subsidiary elements for seeing our hand in motion and have to combine them by some explicit operation, most of them would be long since gone before we got round to them. The lightening speed of tacit integration is due to the simple fact that tacit integration handles its clues simultaneously. We can see this at work in the simultaneous coordination of dozens of muscles for the performance of a skill - which is of course an instance of tacit integration.

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All these features can be recognised in the process of scientific discovery. But I shall speak of this only briefly, because it will be fully treated next week. Let me use a quotation from a text by the English philosopher William Whewell written more than a century ago. In his works I have been happy to find striking anticipations of my own view of science. Speaking of Kepler's discovery of the elliptic path of the planet Mars, Whewell wrote:

> "To hit upon the right conception is a difficult step; and when this step is once made, the facts assume a different aspect from what they had before: that done, they are seen in a new point of view; and the catching this point of view, is a special mental operation, requiring special endowments and habits of thought. Before this, the facts are seen as detached, separate, lawless; afterwards, they are seen as connected, simple, regular; as parts of one general fact, and thereby possessing innumerable new relations before unseen."

There is no question here of a systematic induction, observing that all A-s are B-s checked by the principles of Agreement and Difference propounded by J. S. Mill at that time and still widely acknowledged to-day. Whewell scathingly attacked Mill a few paragraphs further in the same book. He is very conscious of his own distinctive position by speaking of discovery as the difficult step of hitting on the right conception of things. He sees it as the catching of a new point of view, in the light of which the facts take on a different appearance. They had previously appeared unrelated, lawless and now they are seen as connected and regular, as parts of a comprehensive fact. This is tacit integration as I have described it. And to this Whewell makes a most striking addition. He says that by becoming parts of a comprehensive entity the facts acquire innumerable new relations before unseen. I think he speaks here of the unexhaustible implications I have ascribed to the discovery of a true

coherence in nature, the inexhaustible implications arising from the discovery's bearing on reality.

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I have spoken of perception as an instance of tacit knowing and this amounts to a theory of perception. It says that when light from an object falls into our eyes and our body responds to this in a number of ways, we are aware of these events in terms of seeing the object. We are aware of these internal happenings in terms of the position, size, shape and motion of the object, these sights being the joint meaning of these internal events. This, I said, goes on according to the principles of tacit integration, that I have illustrated for a number of other instances given in my table. Subsidiaries are brought into operation by virtue of our integrative powers which produces their joint meaning, a meaning expressed by an appearance not present in the subsidiaries before.

I know that this sounds like the somewhat vague theory of projection, which has been effectively opposed by pointing out that we are not previously aware internally of the sense impressions which we are supposed to project outside. But tacit integration does change the appearance of the subsidiaries in bringing out their joint meaning: Moreover, we have seen experiments by Hefferline and others in which internal events of which we cannot sense in themselves at all can be integrated to the performance of external action. The transposition of feelings in our palm to the far end of a probe when used in exploring a cavity, lends further support to the occurrence of projection as a result of tacit integration. Projection of subsidiary experience to a distante place where it makes sense is clearly established in these cases and authorises in

my view my analogous assumption for the interpretation of perception.

I would venture, therefore, to extend the scope of tacit knowing to include the 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 in Hefferline's experiments. The relation of mind and body becomes then an instance of the relation between the two terms of tacit knowing, the subsidiary and the focal. Such a hypothesis does not explain how perceived sights, or any other states 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.

This conception of the way the body participates in the act of perception can be generalised to include the bodily roots of all knowledge and thought. It throws light then on the peculiar knowledge we have of our body by living in it. It makes us aware of the fact that our body is the only collection of things which we know almost exclusively by relying on our awareness of them for attending to something else. Our body serves as a tool for observing objects outside us and for manipulating these for purposes of our own. Every time we make sense of the world we rely on our tacit knowledge of impacts that the world makes on our body and of the response of our body to these impacts. Such is the exceptional position of our body in the universe.

I have described how we learn to feel the end of a probe hitting things outside. We may regard this as the transformation of the probe into a sentient extension of our body. But our

awareness of our body for attending to things outside it suggests a wider generalisation of the feeling we have of our body. Whenever we are using certain things subsidiarily for attending from them to other things (in the way we usually use our own body) these things change their appearance. They appear to us now in terms of that from which we are attending to them, in the same way as we feel our own body in terms of things outside to which we are attending from our body. In this sense we can say that when we make some things function as the subsidiary term of tacit knowing, we incorporate these things in our body - or extend our body to include them.

Let me show you at a glance the wide consequences of this conclusion. We make a thing function as the subsidiary term of a comprehensive entity whenever we see it as part of a whole. We have analysed many instances of this kind: the seeing of a solid body, Kepler's discovery of eliptical orbits, the identification of physiognomies, the practice of skills. We could apply our present conclusions to all these, but I want to throw a quick glance over wider fields. Biology studies the shapes of living things and the way they grow into these shapes from germ cells; it describes the organs of living things and explains the way they function; it explores the motor and sensory functions of animals and their intelligent performances. All these are comprehensive entities. Morphology, physiology, animal psychology - they all deal with comprehensive entities. The only way to know them is to comprehend the coherence of their parts. The structure of tacit knowing requires that we make these parts function as subsidiary terms, in the way we make our body function for handling things outside. It requires that, in this sense, we interiorise these things in order

to attend from them to the comprehensive entiry which they form. We must dwell in them, and not observe them in themselves if we are to be aware of their bearing on the entities to which they belong. Only thus can we understand the way these comprehensive entities rely on their parts for performing their functions.

This adds another important feature to the structure of tacit knowing. I look forward to showing you as I go on in these lectures that tacit knowing is in fact the sovereign instrument for establishing the existence of comprehensive entities and understanding their structure and operations.

Note: E. A. Hausmann's distinction between the emotional power of a vague allegory and its jaring effect when spelled out explicitely, is born out by the following experiment. The words Happy and Angry were presented subliminally to a subject and were followed by the full presentation of an expressionless face. The words tended to produce a corresponding expression in the face, but they became less effective when presented in full awareness. Thus the meaning of a subliminally seen word appears to be assimilated to the face shown after it, while, when consciously observed, it is experienced separately, without affecting the face. See Gudmund J. W. Smith, Donald Spence, and George S. Klein, "Subliminal Effects of Verbal Stimuli," The Journal of Abnormal and Social Psychology, Vol. 59, No. 2, September 1959.