

FAITH, KNOWLEDGE AND SCIENCE:  
A SYSTEMATIC EXPOSITION OF THE THOUGHT  
OF MICHAEL POLANYI

A Thesis submitted in Candidacy  
for the Degree of Master of  
Philosophy

by  
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ISBN 0-88958-010-3

## TABLE OF CONTENTS

Abbreviations. . . . .	iv
Introduction . . . . .	v
A. TACIT KNOWING. . . . .	1
1. General Remarks. . . . .	1
2. Focal and Subsidiary Awareness . . . . .	4
3. Instrumentalism. . . . .	6
4. Specifiable and Unspecifiable Elements . . . . .	7
5. Tacit Knowing and Various Aspects of its Employment. . . . .	9
a. Acts of Knowing . . . . .	10
b. The Known . . . . .	10
c. Knowing and the Order of Succession in Time. . . . .	11
i. From Past to Present . . . . .	11
ii. From Present to Future . . . . .	12
d. Anthropology. . . . .	12
e. Cosmology . . . . .	13
B. MODES OF KNOWING . . . . .	13
1. The Active Principle and Primitive Faculties . . . . .	13
2. Inarticulate Intelligence. . . . .	16
a. Structural Interrelations: Inarticu- late Intelligence and Primitive Faculties. . . . .	17
3. Articulate Intelligence. . . . .	17
a. Language. . . . .	17
b. Language and Thought. . . . .	19
c. Structural Interrelations: Articulate Intelligence and Inarticulate Faculties. . . . .	21
4. Intellectual Passion . . . . .	22
a. General Remarks . . . . .	22
b. Three Functions of Intellectual Passions . . . . .	24
i. The Selective Function . . . . .	24
ii. The Heuristic Function . . . . .	24
iii. The Persuasive Function. . . . .	25
c. Intellectual Passions as Integrators. . . . .	26

C.	COMMITMENT I. . . . .	27
1.	The Context. . . . .	27
2.	General Remarks. . . . .	28
3.	The Nature of Commitment and Tacit Knowing . . . . .	29
4.	Personal Knowledge . . . . .	32
5.	Framework Modification . . . . .	33
6.	Subsidiary Components and Frameworks . . . . .	35
7.	Commitment in Framework Modification . . . . .	37
8.	Intellectual Passions and Commitment . . . . .	38
D.	SCIENCE: DISCOVERY and the LOGICAL GAP . . . . .	40
1.	Problem Solving. . . . .	40
2.	The Logical Gap. . . . .	41
3.	Tacit Knowing and the Logical Gap. . . . .	42
4.	Commitment in Discovery. . . . .	45
5.	Discovery, Commitment and Change . . . . .	47
6.	Truth. . . . .	49
E.	SCIENCE: FACTS, EVIDENCE and THEORIES . . . . .	51
1.	General Remarks. . . . .	51
2.	Universals . . . . .	52
3.	Theory and Fact: The Problem of Correspondence. . . . .	56
4.	Probability. . . . .	58
5.	Irreducibility . . . . .	58
6.	Order and Randomness . . . . .	60
7.	Evidence . . . . .	61
F.	SCIENCE AND ITS PREMISES . . . . .	63
1.	Pre-Scientific Knowledge . . . . .	63
2.	Definitions and Explanations: Focal Analysis of Subsidiary Particulars. . . . .	66
3.	Maxims . . . . .	68
a.	Maxims and Skills. . . . .	68
b.	Maxims and Learning. . . . .	70
4.	Science and its Axiomatization . . . . .	72
5.	Limits of Scientific Axiomatization and Personal Beliefs. . . . .	76
6.	The Nature of Assertions . . . . .	81

G.	COMMITMENT II . . . . .	84
1.	The Personal and the Universal . . . . .	84
2.	Responsibility . . . . .	89
3.	The Stability of Commitment. . . . .	91
H.	GENERAL ANTHROPOLOGY and COSMOLOGY . . . . .	94
1.	Anthropology . . . . .	94
2.	Cosmology. . . . .	98
I.	CONCLUSION . . . . .	102
1.	The Spirit of Michael Polanyi. . . . .	102
2.	Appraisal and Critique . . . . .	105
a.	The Problem of Continuity and Discontinuity . . . . .	105
b.	Focal and Subsidiary Awareness . . . . .	106
c.	Scientific Discovery: The Knower and the Known . . . . .	107
d.	The Problem of Autonomy and Self- Determination . . . . .	110
e.	Truth Commitment and Evolutionism. . . . .	113
f.	Michael Polanyi, a Significant Con- tributor to Epistemological Theory. . . . .	116
	Notes. . . . .	118
	Bibliography . . . . .	124

ABBREVIATIONS

K.B.	<u>Knowing and Being</u>
P.K.	<u>Personal Knowledge</u>
S.F.S.	<u>Science Faith and Society</u>
S.M.	<u>The Study of Man</u>
T.D.	<u>The Tacit Dimension</u>

## INTRODUCTION

The purpose of this inquiry is to explore the general thought of Michael Polanyi with a special focus on his philosophy of science. More specifically however, we will concern ourselves with the function of personal commitment in scientific knowing, a theme that appears to be central to Polanyi's work. In view of the fact that his philosophy of science exhibits a phenomenally complex integration of ideas and concepts drawn from a variety of sources, our analysis will of necessity make numerous digressions into areas that fall outside the legitimate limits of science. The necessity of doing so is in no way arbitrary, but is imposed upon us by Polanyi's own view of scientific knowing, the structure of which exhibits not only a striking continuity but also a structural similarity with non-scientific modes of knowing.

For this reason our approach to Polanyi's philosophy of science will attempt to follow a methodological procedure that would lay bare a fundamental structure of his thought. His theory of science will thus be treated directly in light of his most basic and ultimate philosophical distinctions. By employing such an approach we hope to disclose a systematic coherence which underlies his theory of science in such a way, so as to reflect its systematic integration with not only the structure of non-scientific modes of knowing but even the general anthropological and cosmological models which it implies. We will try, in other words, to expose Polanyi's philosophy of science from the vantage point of the ultimate principles that grant his over-all thought its typical philosophical identity.

With such a purpose in mind our analysis will proceed as follows. In chapter A we will exclusively concern ourselves with uncovering the basic methodological principles that undergird Polanyi's thought. This will entail an attempt to explicate his philosophical paradigm as distinctly as possible. We believe that the principle of tacit knowing constitutes the core of Polanyi's philosophical perspective. Our first chapter will consequently consist of an analysis of its basic structure in light of the general manner in which it is employed. In this sense chapter A may be considered as the most important part of our inquiry furnishing the systematic ground upon which all subsequent chapters depend.

Assuming the principle of tacit knowing, chapter B will focus on the structure and interrelationships of various levels of knowing, beginning with the most primitive stages of awareness followed by inarticulate intelligence and concluding with articulate intelligence as the foundation of scientific thought. While looking at the specific manner in which each level of knowing operates, allusions will be made to the functional presence of personal commitment.

Chapter C will furnish an initial explication of the nature of commitment clarifying some of its most general features with regard to the relationship between frameworks of beliefs and human knowledge.

From the perspective established in the first three sections the subsequent chapters D, E, and F, will center exclusively on science. First, we will concern ourselves with the structure of scientific discovery and its relationship to personal commitment. This will be followed by an analysis of more specific issues in the philosophy of science, such as the formation of universals, the relation of theory and facts, probability, order and randomness and the role of evidence. These sections exclusively devoted to science will end with an inquiry into the premises of science exploring the presuppositions upon which it rests. In this context we will examine the role of formal maxims relative to the dimension of personal commitment and belief.

Chapter G will recapitulate the nature of personal commitment, while expounding upon certain fundamental aspects of its structure pertinent to the problem of subjectivism, human responsibility and the stability of personal beliefs.

Our exposition of Polanyi's thought will close with a brief survey of his anthropological and cosmological models implied in his epistemological theory in an attempt to disclose the overall systematic integration of his philosophy.

We will conclude our inquiry with an assessment of Polanyi's theory of knowledge. Some general statements will be made regarding his place in the modern philosophical tradition followed by an appraisal and critique in which the strengths as well as the relative weaknesses of Polanyi's thought will be exposed.

## A. TACIT KNOWING

### 1. General Remarks

The most fundamental philosophical principle operative throughout the entire work of Michael Polanyi is that of tacit knowing. Its centrality becomes evident in his general theory of knowledge, particularly in his philosophy of science, in his anthropology and even in his overall ontology of the cosmos. It appears, however, that the concept of tacit knowing has been conceived and has arisen in the context of epistemological problematics.<sup>1</sup> Its original formulation was intended to solve primarily problems in theory of knowledge rather than in any other branch of philosophy. For this reason, therefore, an inquiry into the structure and various functions of the tacit principle cannot be understood unless it begins with an exposition of its epistemological employment. What then is the meaning of tacit knowing?

In his book The Tacit Dimension, Polanyi embarks on an explanation of tacit knowing on the basis of the important thesis "we can know more than we can tell". (T.D., p.4). According to this proposition not all that one is aware of can be exhaustively stated in articulate form. Any attempt to state explicitly all that one knows about a matter will end in failure, for there will always remain a residue of unspoken knowledge with respect to that which is known. But what is more important for an understanding of Polanyi's notion of tacit knowing is the converse aspect of this relationship. That is, what one can tell through an explicit utterance is ultimately rooted in and dependent upon a knowledge that cannot be exhaustively stated or told. A person's uttered knowledge rests upon his inarticulate knowledge. (S.M., p. 18)

To illustrate these relationships, Polanyi refers to the processes by which facial expression or physiognomies are recognized. The recognition of a person's face among millions of other faces is normally a common affair. Such knowledge is usually taken as dependable and certain. However, explains Polanyi, though people are certain about having identified a physiognomy, they usually cannot tell how they do this (T.D., pp. 4,5) And further, even when a stated explanation is given, not only can it never exhaust a person's original recognition of that physiognomy, but it in fact remains always dependent on the prior, unstated identification of the physiognomy. The general principle of this illustration asserts therefore, that all uttered knowledge relies on an inarticulate knowledge, which as such cannot be put into words. At the juncture of this relationship, between a person's non-statable awareness and his explicitly uttered statements lies the tacit dimension of his knowledge. It pertains to the interrelated integration of the two contrasting levels of his awareness. But we must elucidate the principle of tacit knowing further.

Occasionally Polanyi expresses an indebtedness to Gestalt psychology for demonstrating that we may know something by integrating our awareness of its particulars, without being able to identify these particulars (T.D., p.6; P.K., p. 57; S.M., p. 28) On the basis of this insight Polanyi proceeds to expound his analysis of the structure of tacit knowing. Before we continue however, we must note that Polanyi's view of this integrating process differs from Gestalt psychology in one major respect. While Gestalt psychology assumes that knowledge by integration occurs through a spontaneous equilibration of the particulars on the retina or the brain, Polanyi believes that a Gestalt is the result of an active shaping of experience by the knower himself. This power of integrating particulars, according to Polanyi, discloses the key for understanding the structure of tacit knowing, as the indispensable principle in the acquisition of all knowledge. In Polanyi's words:

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. (T.D., p.6)

The most explicit analysis of the structure of tacit knowing is given in reference to a novel experiment first performed in 1949. In this experiment a person was presented with a sequence of nonsense syllables. As the latter were shown to the person, an electric shock was consistently administered following the appearance of certain specific syllables. In the course of the experiment the person had learned to anticipate the shocks followed by the "shock syllables". But upon questioning, he was unable to identify which syllables gave him the clues for anticipating the shocks. He knew when to expect a shock, but could not explicitly state what elicited such expectation. (T.D., pp. 7,8) Polanyi explains that the knowledge acquired here is akin to that of knowing a physiognomy, where one's knowledge cannot be reduced to the explicit identification of each particular element that comprises it.

In the above experiment two components are distinguished as indicative of the basic structure of tacit knowing. On the one hand there are the shock syllables and the shock associations, while on the other there is the electric shock which followed them. In learning to anticipate the shocks, explains Polanyi, the person had to rely on his perception of the particular shock producing syllables which preceded them. But the focus of his attention, he emphasizes, was not centred primarily on the particular syllables associated with the shocks. Rather, it was directed at the electric

shocks themselves. The person's foremost concern was the emergence of the shocks, not the explicit identification of the particular signals preceding them. To be sure the range of awareness involved in the learning process encompassed a knowledge of the shock syllables. But Polanyi's fundamental point is that the subject's awareness of the shock syllables was merely an implicit one. His knowledge of the latter functioned not as an end in itself, but as a clue in terms of which he could orient his attention to the electric shocks.

This relationship sets a qualification also on the manner in which the syllables were comprehended. For the subject, the implicit meaning of the syllables was defined in terms of the purpose they intended to facilitate. He was aware of their meaning only as aids or clues for coming to know when to anticipate the shocks. (T.D., p.9) In this light it is explained how the accurate anticipation of the shocks, as the prime object of the subject's attention, was achieved by relying on an implicit awareness of the syllables, the meaning of which was determined by the purpose of their employment.

Here, according to Polanyi, the two components of tacit knowing are disclosed. An implicit awareness aiding an attended purpose; the syllables are known implicitly as they are relied upon for attending to the electric shocks. "Such", Polanyi explains, "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." (T.D., p. 10)

From this analysis Polanyi established his from-to schema, as the intrinsic characteristic of tacit knowing. He states 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. (T.D., p. 10)

In the case of the electric shock experiment, the person attends from the shock-anticipating syllables to the administered shocks. In the case of recognizing a physiognomy one attends from the features to the face.

Viewed in turn from each pole, the from-to relation between the two terms of tacit knowing exhibits two mutually related dimensions. When the relationship is considered from the first term of tacit knowing, namely, the from pole, the fact is revealed that the intentional pursuit of a specific kind of knowledge is arrived at from a dependence on an implicit awareness of certain particulars. This dimension Polanyi calls the "functional structure of tacit knowing". (T.D., p. 10) At the same time, when the same relationship is viewed from

the other term of the tacit relation, namely, the to pole, it is established that the implicit particulars relied upon are known only in terms of the object which is explicitly attended from them. As Polanyi puts it "we are aware of that from which we are attending to another thing, in the appearance of that thing". This aspect of the tacit relation he calls the "phenomenal structure of tacit knowing." While the functional structure designates the dependence of what is known on the implicit awareness of its associated particulars, the phenomenal structure indicates how the joint meaning of the parts is centered onto the thing attended. In the first case the tacit relation is looked upon from the point of view of the parts as they jointly support that which is focussed upon. In the second case the relationship is viewed from the vantage point of what is attended, as it organizes the various particulars that are associated with it into a coherent configuration.

## 2. Focal and Subsidiary Awareness

In his main work Personal Knowledge, Polanyi refers to the from-to structure of tacit knowing, with its two correlative dimensions, in terms of two kinds of awareness, subsidiary and focal. Concrete acts are analyzed by reference to their subsidiary and focal components. To hammer a nail, for example, one has a subsidiary awareness of the feeling in the palm of his hand which is merged into his focal awareness of driving the nail. (P.K., p. 55)

In the context of this analysis Polanyi states the fundamental thesis that subsidiary and focal awareness are mutually exclusive. (P.K., p. 56) In an act, what functions subsidiarily cannot be attended to focally. This holds true also in the opposite direction; ie., the focal facet of an act cannot be treated in a subsidiary manner. If such a transformation is attempted, it will result in the destruction of the act of knowing. The specific nature of the act will be altered beyond recognition. To illustrate this point, Polanyi uses the example of a performing artist. When a pianist, for instance, shifts his attention from what he is playing to the observation of what he is doing with his fingers he will meet with confusion, often to the point where his performance will be hindered. (P.K., p. 56) In playing the piano an awareness of what he is doing with his fingers is involved, of course, but such an awareness is only subsidiary to what is focally attended to, namely, the song being played. Similarly, when an actor anxiously fixes his attention on the next word to be remembered, instead of the act to be performed, his act will soon lose its authentic character, being reduced thereby to a mere recitation of prescribed phrases. By doing so the actor divorces himself from what ought to be focally attended, namely, the performed act, which alone can evoke the proper sense of the words to be recalled. (P.K., p. 56)

Two main points should be noted from the preceding analysis. The first is that one's attention can only hold one focus at a time. Secondly, all subsidiary particulars of an act lose their original meaning if they are attended to focally. For in so doing, one loses sight of the patterned act they jointly constituted. (P.K., p. 57)

Up to the present point we have distinguished the two basic moments constituting the structure of tacit knowing, namely the focal and the subsidiary. However, further elucidation is required in order to clarify and complete the precise meaning of this concept. It is of crucial importance to note that the focal and subsidiary principles do not in themselves exhaust the structure of tacit knowing. By themselves they can explain nothing. A proper understanding of Polanyi's principle of tacit knowing cannot end with the mere identification of its two contrasted components. Neither can it rest on establishing the relationship between them. If the principal structure of tacit knowing is to be grasped, one must probe deeper.

In his essay "The Logic of Tacit Inference" (1964), Polanyi describes the manner in which sounds are transformed into a name referring to a specific object. "A set of sounds", he states, "is converted into the name of an object by an act of tacit knowing which integrated the sounds to the object to which we are attending." (K.B., p. 145) Here, we observe that the act of tacit knowing performs an integrating function bringing together its two components. The sounds as the subsidiary element, and the object, as the focal component are joined to one another in an act of tacit knowing. But is this an integration of two originally independent principles? Apparently not, for Polanyi presents the focal and subsidiary levels of awareness as "the two terms of an act of tacit knowing which jointly comprehends them." (T.K. p. 35) Tacit knowing presents a unitary structure within which the two contrasting levels of awareness exist as derivative components. This pattern becomes evident in the essay "Sense-Giving and Sense-Reading", where the structure of tacit knowing is referred to in terms of not merely two, but in terms of three principles. Here, Polanyi speaks of tacit knowing as a structure comprised of a "triad", such that it "consists in subsidiary things (B) bearing on a focus (C) by virtue of an integration performed by a person (A)". (K.B. p. 182) As the act of a person, component (A) is the common root in which (B) and (C) find their unitary integration. The relationship between focal and subsidiary is thus preceded by an antecedent tacit act, in which the two terms to tacit knowing find their common locus. It must be made clear that tacit knowing does not consist of a conjunction between two originally independent principles. On the contrary, as an act, tacit knowing comprehends and includes both focal and subsidiary knowledge. (T.D., pp. 34,35) It is only within such a comprehension that the from-to relationship between its two terms is determined.

These relationships are illustrated also in the way Polanyi analyzes the process of perception. As constituents of tacit knowing, subsidiary particulars and a focally perceived object, he explains, are joined together by tacit activity; through "its characteristic power of integration, merging the subsidiary into the focal". (K.B., p. 141)

It must be noted, further, that in their integrated coherence, the focal element relates to the subsidiary element as a higher to a lower level of awareness. For an explicit statement on this matter one can turn to Polanyi's essay "The Structure of Consciousness" (1965). In the course of an exposition concerning the knowledge of external objects, he states that active consciousness, operative according to the principle of tacit knowing,

achieves coherence by integrating clues to the things on which they bear or integrating parts to the wholes they form. This brings forth the two levels of awareness: the lower one for the clues, the parts or other subsidiary elements and the higher one for the focally apprehended comprehensive entity to which these elements point. (K.B., p. 214)

It can now be said that in so far as tacit activity is identified with the principle of integration, it presents itself as the original unity in which the focal and subsidiary dimensions, or the higher and lower levels of awareness, are rooted. It is the origin in which the two aspects of knowledge cohere.<sup>2</sup> At this point we should note that just as the focal and subsidiary principles are irreducible to one another, so also is the integrating function of tacit activity irreducible to any of the two terms of tacit knowing. As higher and lower levels of awareness, both focal and subsidiary components are mutually comprehended in the act of tacit knowing. Hence in its integrating capacity tacit activity emerges as the most basic and original category, with the focal and subsidiary levels as a secondary bifurcated duality within it. We can now say that the tacit structure, properly speaking, consists of an integrating activity merging together focal and subsidiary awareness as its two contrasting constituents.

### 3. Instrumentalism

Having established the skeletal structure of tacit knowing, we can now proceed by mentioning various secondary features that characterize the internal workings of the schema. They are concerned particularly with certain aspects of the relationship between the focal and subsidiary elements; the higher and lower levels of awareness.

As the two terms of knowing relate, they take on specific functions with respect to one another. The higher focal dimension coordinates the arrangement of the lower particulars so as to serve a specific intention. In so doing the focal element uses the particulars as instruments for its focusing purposes. (S.M. p. 44) In this process, therefore, the particulars governed by the subsidiary principle, acquire an instrumental operation.<sup>3</sup> To use one of Polanyi's examples, it can be said that the knowledge of particulars which enters subsidiarily into the act of riding a bicycle does so as an instrument used in the performance of such a skill. As subsidiary knowledge of particulars is never known explicitly in itself, Polanyi states that "I know the particulars of what I know only in an instrumental manner and am focally quite ignorant of them." (P.K., p. 88)

Similar remarks are also made in his analysis of textual meaning. The different elements that are involved which together sustain the text's meaning are looked upon as instruments on which the focal meaning of a passage relies. "The meaning of a text," according to Polanyi,

resides in a focal comprehension of all the relevant instrumentally known particulars, just as the purpose of an action resides in the coordinated innervation of its instrumentally used particulars. (P.K., pp. 92,58,59)

In view of this instrumental function of subsidiary parts, Polanyi refers to the subsidiary knowledge of particulars as "instrumental knowledge". (P.K., p. 88)

The phenomenon of instrumentalism is also evident in Polanyi's examination of the manner in which new skills are achieved, such as handling a hammer, a tennis racket or driving a car. A new skill, he claims, is learned through a process of unconscious trial and error manipulation of subsidiary elements until they give rise to the consciousness of the skill in question. This occurs through the operational results achieved through the instrumental use of subsidiary parts. Learning a skill therefore, involves "a structural change achieved by a repeated mental effort aiming at the instrumentalization of certain things and actions in the service of some purpose". (P.K., pp. 61,62)

#### 4. Specifiable and Unspecifiable Elements

Finally, we must mention that the instrumental relationship of subsidiary parts to their focal purpose exhibits an unspecifiable nature. We have seen that when one focuses on a whole entity, he is also aware of its parts, which participate in sustaining the meaning of what is focused upon. But in order for the

parts to do so, emphasizes Polanyi, they must at all times remain subsidiary. Only in this way can they contribute to the focal whole in which they are integrated. For this reason their relationship to the focal element renders them unspecifiable. If one attempts to specify their relationship to the whole by attending to them focally, he will destroy the very meaning of the parts. For if they are scrutinized focally they cease to function as subsidiary and if they cease to function subsidiarily they will no longer contribute to the original whole they intended to sustain. (P.K., pp. 56, 57) This is not to say that an explicit analysis of the way the parts function in a whole is meaningless. What it does mean, however, is that paying focal attention to the parts can never substitute the prior comprehension of the parts in their subsidiary functioning with respect to a focal purpose. (T.D., pp. 18, 19) From the point of view of their principal operation, the knowledge of subsidiary particulars, as a lower level of awareness, remains implicit, unspecifiable, resisting any definitive identification.

According to Polanyi, one succeeds in learning a skill through a process of selecting particulars which he finds helpful for his achievement, without being able to identify them as they would appear in themselves, ie., as specifiable entities. He states that

This is the usual process of unconscious trial and error by which we feel our way to success and may continue to improve on our success without specifiably knowing how we do it -- for we may never meet the causes of our success as identifiable things which can be described in terms of classes of which such things are members. (P.K., p. 62)

This is the way, explains Polanyi, that one invents the methods of swimming or cycling. He arrives at them without a specifiable knowledge of all the particulars that enter into such a skill, as for example the regulation of one's breath, a sense of balance etc.

Since this kind of unspecifiable, subsidiary awareness is an intrinsic dimension of tacit knowing, and since the latter is the principle by which all knowledge is acquired and held, it follows that "no knowledge can be wholly explicit". (P.K., p.x; S.M., p. 25) And herein lies the meaning of Polanyi's fundamental thesis, "we can know more than we can tell".

However, although no knowledge can be definitively exhausted, this does not in Polanyi's position militate against the possibility of specifiable knowledge as well. This is indeed possible, but under one condition. Only things "of which we are focally aware," he explains, "can be explicitly identified". (P.K., p.x) Specifiability therefore, entails only the focal aspect of a known

entity, while remaining at all times dependent upon an indefinite, subsidiary awareness. Within such a formulation we observe that both unspecifiable and specifiable knowledge acquire certain conditional limits. While the former is confined within the range of subsidiary awareness, the latter is bound to focal awareness. (T.D., pp. 9,10)

With our exposition of specifiability we have now arrived at a complete picture of the basic structure of the tacit coefficient of human knowledge. We can recapitulate its basic structure by summarizing our findings as follows: as the principle of all knowledge, tacit knowing is a singular integrating activity merging together a focal and a subsidiary component, as its higher and lower levels of awareness. In their interrelated coherence, focal and subsidiary knowledge are irreducible and mutually exclusive. The lower, subsidiary awareness performs an instrumental operation with respect to the higher focal purpose, while remaining at all times unspecifiable. The focal dimension, on the other hand, while relying on instrumental subsidiary knowledge, delineates an area of knowledge that lends itself to specifiable, explicit identification and definition. <sup>4</sup>

## 5. Tacit Knowing and Various Aspects of its Employment

The precise manner in which the various components of the tacit principle have been found to interrelate must be regarded as extremely crucial. For it appears that the principle of tacit knowing conditions the most fundamental ingredients of Polanyi's philosophy. It provides the most comprehensive methodological norms in terms of which philosophical problems are tackled. The structure of the tacit principle furnishes the thread that grants systematic integration to Polanyi's epistemology, anthropology, cosmology and to the manner in which specific issues within these areas are treated. From the very outset therefore, one must clearly understand the precise structure of the tacit principle. Failure to do so would render Polanyi's work incomprehensible, giving rise to numerous insoluble ambiguities undermining the overall systematic coherence of his thought.

As an original and singular principle exhibiting a derivative instrumental contrast between a focal and subsidiary component, the tacit structure discloses itself as the fundamental paradigm out of which Polanyi operates. The burden of our subsequent analysis would be to show that this is in fact the case. But if such a principial claim is indeed consonant with Polanyi's thought, it would imply that any misconception regarding the precise structural pattern of the tacit principle must of necessity lead to a distorted understanding of Polanyi. One would fundamentally miss the basic contours of Polanyi's thought, forging a methodological key that fails to unlock his philosophical universe. What immediately follows is a preliminary attempt to disclose the primary ways in which the tacit principle is employed. One

should note, as we proceed, that in its determinative role, the principle of tacit knowing is often relevant in areas that fall outside the legitimate limits of philosophical epistemology.

#### a. Acts of Knowing

It has already been amply demonstrated that in an act of knowing the particulars immediately present find their meaning as they are jointly coordinated in what is focally attended, and that what is focally attended finds its support in the particulars that enter into its constitution (T.D., pp. 12, 13). The examples of the performing artists have been given as concrete illustrations of this relationship. In this context the structure of tacit knowing emerges as the primary structure of all acts and skills of knowing. It is employed as the principle of the act-structure. As such it guarantees the coherence of every act, while guarding against the reduction of acts to their constituent elements.

#### b. The Known

A further employment of the tacit principle surfaces in Polanyi's conception of the structure of entities as objects of knowledge. In coming to know something both the focal and subsidiary components of tacit knowing are involved. Furthermore, in the light of the fact that it establishes a meaningful relation between the two elements, tacit knowing is identified with an understanding of the comprehensive character of the entity that comes to be known. And in turn the entity is correlated to the knower in accordance with the structure of tacit knowing. The comprehensive nature of a known object is thus looked upon in terms of a unitary integration between its subsidiary particulars and their joint meaning in a focal whole (T.D., p. 13). Here we see that the principle of tacit knowing determines also the primary structure of the object in a field of knowledge.<sup>5</sup>

Throughout the entire section on "Knowing and Being," in his Personal Knowledge, Polanyi operates with the assumption that our knowledge of living beings entails an awareness of their comprehensive nature which is constituted by a subsidiary awareness of their parts and a focal awareness of the whole in which the parts jointly cohere. Moreover, in accordance with the structure of tacit knowing the latter aspect of the known entity has a value that is irreducible and absent from its constituent particulars (P.K., p. 327). Elsewhere it is explicitly stated that in all instances of tacit knowing one finds a "correspondence between the structure of comprehension and the structure of the comprehensive entity which is its object" (T.D., p. 33). Hence not only human knowing has a tacit structure but also the entities that are known.

### c. Knowing and the Order of Succession in Time

#### 1. From Past to Present

The tacit principle also surfaces as the order of succession in time. The sequence in time through which one comes to knowledge proceeds in accordance with the tacit pattern. This occurs in two respects. In the first case the relationship between past experience and the emergence of knowledge in the present is analogous to the relationship between the subsidiary and focal components of the tacit principle. What has been learned in the past functions subsidiarily in the present, in conjunction with what is being focally attended in the present. There are numerous examples which Polanyi uses to illustrate this relationship.

In his analysis of textual meaning he argues that the meaning of the words cannot be elicited by simply attending to the words themselves in the text. A person's capacity to comprehend the text's message involves factors that go beyond the immediate appearance of each word. It entails the reader's past experiences in which he himself heard or used the words present in the text. Although one's past encounters and usages of symbols have no tangible character, they have nevertheless a reality, insists Polanyi, that remains latent in the person. Such past experiences are subsidiarily operative in the present as they exert a bearing on the focal meaning of the text. They are the particulars from which one attends to the text's message. Polanyi states that

When I receive information by reading a letter and when I ponder the message of the letter, I am subsidiarily aware not only of its text, but also of all the past occasions by which I have come to understand the words of the text, and the whole range of this subsidiary awareness is presented focally in terms of the message. (P.K., p. 92)

Here again, the integration of subsidiary past experiences with what is presently focused upon is achieved through an act of tacit knowing.

In a similar manner Polanyi analyzes the process of visual perception. The latter is described as an activity which seeks to satisfy standards set to itself. The muscles of the eye adjust so as to produce an image anticipating the satisfaction of such standards, in which one believes to have comprehended the object. This process begins very early. From childhood for example, argues Polanyi, one must make a choice as to whether objects swell up and retain their distance from their viewer, or retain their size and change their distance. (P.K., p. 96) Such past choices, even though they are beyond recall, accumulate into a residue of subsidiary knowledge, which jointly comes to sustain perception in terms of what is focused upon. The determination of perception

by clues from past experiences is often so strong that when a person is asked to visualize an artificially constructed image, he will see it in terms of his past encounters, even when the constructed image is entirely contrary to everything he has ever perceived (P.K., p. 96; K.B., p. 165). Hence perceptions of the past relate to visualizing in the present as subsidiary awareness to focal attention. The two elements are in turn interrelated by the integrating power of tacit knowing.

Finally, the same structure applies to the educational development of persons. "Education," Polanyi says, "is latent knowledge, of which we are aware subsidiarily in our sense of intellectual power based on this knowledge." (P.K., p. 103). Here too, past learning becomes the subsidiary background for focally attending present experiences.

#### ii. From Present to Future

We have just seen how the tacit principle determines the order of succession in the relationship between past and present knowledge. But there is yet more to be said, for it also holds for the manner in which knowledge possessed in the present anticipates the acquisition of knowledge in the future.

This order is vividly evident in the way persons are urged to move in a direction which leads eventually to a discovery. Polanyi explains how the potential discoverer has "intimations of something hidden" which he hopes to uncover, even though the discovery anticipated has, as of yet, no specific contours. All the evidence that the discoverer has presently at his disposal are merely particular clues pointing the way to a reality waiting to be disclosed. They do so as the various pieces of evidence allude to a certain coherence configuration in which they function as subsidiary parts. (T.D., pp. 23, 24; P.K., pp. 116, 117; S.F.S., pp. 23, 24). The discoverer strains to focus onto the hidden reality as he considers his present evidence to be operating as subsidiary elements of his expected discovery; as he thinks from them by being subsidiarily aware of them (P.K., p. 127, 128; K.B., p. 171). When certain given knowns are made to function subsidiarily in the present, then discovery is anticipated in the future. This is what Polanyi calls the "anticipatory powers" of thought. The integration of the present particulars with what will become focally evident in the future, again, occurs in accordance with the structure of tacit knowing.

#### d. Anthropology

Moving to the area of anthropology, we discover that here too, the tacit principle plays a decisive role. Polanyi's anthropologic model consists of a differentiation of an originally single principle of vital life into various levels of consciousness, in the context of a primary bifurcation between mind and body. The relati

between mind and body, as well as that between the various levels of consciousness is determined according to the principle of tacit knowing. All lower levels in his anthropology bear a subsidiary operation with respect to higher levels viewed as focal centers of consciousness. Polanyi's position on these matters becomes quite evident in his essay "The Structure of Consciousness" (1965), where he tries "to show that the relation between body and mind has the same logical structure as the relation between clues and the image to which the clues are pointing". (K.B., p. 231)

#### e. Cosmology

Finally, the employment of the tacit principle is extended to comprehend the structure of Polanyi's entire cosmology. In an evolutionistic perspective, the order of the whole universe emerges as a growing process of ascending complexity, in which the interrelations between the different levels of the cosmos exhibit a tacit structure. (T.D., p. 49) As an inorganic matter gives rise to increasingly higher strata of life, one observes a coordinated interdependence of lower and higher reality akin to the manner in which the subsidiary relates to the focal dimension in the principle of tacit knowing. (T.D., pp. 34,35) The tacit structure of this evolutionary, cosmological hierarchy, Polanyi explains rather technically in his essay "Life's Irreducible Structure" (1958).

### B. Modes of Knowing

#### 1. The Active Principle and Primitive Faculties

In the preceding analysis we attempted to show precisely how the various components of tacit knowing are interrelated, while claiming that the tacit principle plays the most determinative role in Polanyi's thought. We thereupon proceeded to show in a tentative and very general way how the tacit principle orders Polanyi's conceptions of the structure of acts of knowing and the known, the sequential order to the knowing process in time, as well as the general structure of his anthropology and cosmology. With these broad directives in mind we will now turn to scrutinize acts of knowing more closely and thereby show more specifically and concretely what is implied in the conclusions we reached thus far.

Within the context of the general structure of tacit knowing, Polanyi attempts to account for what he calls man's "intellectual strivings". The latter, he defines as "our intensive personal participation in the search for and conquest of our knowledge". (P.K., p. 96) Such a disposition, Polanyi claims, lies in an "active principle", which is continuous with primitive animal impulses and cravings. This active principle characterizes a dynamic active process which strives to meet self set standards, while being motivated by the anticipation of self satisfaction.

Polanyi illustrates this process by an examination of visual perception, in which he states the following:

Perception is manifestly an activity which seeks to satisfy standards which it sets to itself. The muscles of the eye adjust the thickness of its lens, so as to produce the sharpest possible retinal image of the object on which the viewer's attention is directed, and the eye presents to him as correct the picture of the object seen in this way. This effort anticipates the manner in which we strive for understanding and satisfy our desire for it, by seeking to frame conceptions of the greatest possible clarity. (P.K., p. 96)

But Polanyi also notes that there are cases where sharpness of contour does not predominate in the shaping of what is seen. This is particularly the case with an artificially constructed optical illusion, where the observer views the object in an entirely misconstrued manner. When, for example, an object resembling a tennis ball is inflated against a featureless background, it is seen as if it retains its size and comes nearer to the viewer. According to Polanyi, the reason why these misleading images are accepted is due to an overpowering effect of the active principle. Here, it is explained, the eye strains to make sense of the object in accordance with self set standards chosen in the light of how one is accustomed to things making sense. It is claimed that

These defects of the quality and position of our retinal images are accepted here by the eye, in the urge to satisfy the more pressing requirement of seeing the object behave in a reasonable way. (P.K., p. 96)

The tennis ball experiment intends to illustrate how the active principle attempts to establish a coherence between all the clues of visual perception, in which the connection between the viewer's subsidiary awareness of particulars and the whole object focused upon satisfies him "of having truly comprehended the thing seen". (P.K., p. 97) In so doing, the active principle leads the faculties which it governs to pursue their respective goals, while affirming their success by urging them to move from obscurity to clarity, from incoherence to coherence; by compelling them to choose those particular clues which, in their subsidiary functioning, suggest a meaningful whole. (P.K., pp. 99, 100, 101) And such is the process whereby cravings and striving are satisfied while guided by self set standards.

The functional relevance of the active principle is spoken of with regard to two levels of operation, namely drive satisfaction and perception. Both of these operations are described as the

"primordial rudiments" of higher levels of intellectual behaviour. (P.K., p. 99) They prefigure higher stages of intellectual capabilities. Hence, in so far as the active principle governs these faculties, it presents itself as the active regulator of the original, primordial strivings. It pilots the behaviour of the lowest functions of purposive achievements.

From our preceding analysis, we must further note the close resemblance between the structure of the active principle and that of tacit knowing. (P.K., p. 132) The close affinity between them becomes quite evident in view of the fact that the primary function of both is to integrate various particulars into meaningful focal wholes. To this extent the two principles are quite identical. It can thus be said that as an integrating power, the active principle is nothing other than the dynamic integrating process of tacit knowing, as it appears in its most primitive form; on the lowest level of knowing awareness.

The role of self set standards in acts of tacit integration has been mentioned thus far only in an indirect manner. Yet as we shall see from our subsequent analysis, the function of self set standards will prove exceedingly important for understanding Polanyi's thought. Hence, as a preliminary orientation to what follows, we can at this point mention tentatively some of the key features surrounding this phenomenon.

Polanyi claims that the setting and meeting of standards by each of man's strivings involves a personal endorsement. The satisfaction achieved by one's cravings in meeting their own standards is necessarily accompanied by a personal accreditation of his cravings for having met such standards. These strivings,

can be said to be what they are and to achieve what they are said to achieve, only to the extent to which we accredit their implied assent to their own performance, shaped by them in accordance with standards set by themselves to themselves. (P.K., p. 100)

Furthermore, the accrediting of one's strivings in terms of their self-set standards is only possible on the basis of a tacit act, the performance of which implicitly confirms its own rightness. This is so, in view of the fact that all the particulars involved in a striving process receive satisfactory integration under their self-set standards only through the active principle of tacit integration, in which the unity between particulars and their striving focal purpose is found. Such strivings, in which particular components are integrated in accordance with set standards, Polanyi refers to as forms of tacit assent.

In the context of what has been said about the active principle, the process of tacit assent is traced by Polanyi back to inarticulate and sub-intellectual strivings, such as the adaptation of sense

organs to achieve certain accredited purposes, the urge of appetites seeking self satisfaction and many others; a process which will be found to lie, as we shall see, at the foundation of Polanyi's epistemology of Personal Knowledge.

## 2. Inarticulate Intelligence

A developing evolutionary process guided by the active principle brings about continuous intensification of the tacit power of integration. As this occurs, claims Polanyi, higher levels of inventive achievement emerge, in which the original principle of tacit knowing is manifested, only now displaying a power that exceeds that of its previous occurrences. (T.D., p. 49) Intelligence is one such level, which emerges with higher animals and also with man through an unbroken continuity. Under a section in his Personal Knowledge entitled "Inarticulate Intelligence" Polanyi attempts to investigate the most primordial constituents of intelligence through an examination of animal and child behaviour. (P.K., p.71) The investigation proceeds under the assumption that wherever learning is encountered there is intelligence. His analysis discloses three basic levels, or components of intelligence. First there is trick learning which consists of learning to contrive useful effects by the discovery of means-ends relationships. (P.K., p. 72) Then there is the level of sign learning where the animal observes sign-event relationships. It is also mentioned that contriving skills, being more completely controlled by purposes and more direct in its intent than sign learning, lies at a lower level than sign learning, which is guided by a general alertness. (P.K., p. 73) Finally, there is a third level of intelligence. This involves a process of reorganization which aims at achieving "a true understanding of a situation which has been open to inspection almost entirely from the start." (P.K., p. 74) It entails the acquisition of a "mental map", which once learned can be reapplied in many unpredictable ways to solve problems that might be encountered. For this reason it is also referred to as "latent learning". In addition, Polanyi mentions that the first two modes of learning are

more primitive and rooted respectively in the motility and sentience of the animal, while the third handles both these functions of animal life in an implicit operational intelligence. (P.K., p. 71)

This kind of intelligence, which infants and animals have in common, Polanyi calls "inarticulate intelligence", for it does not involve utterances of any kind. Such an intelligence is continuous with the more primitive strivings and like the latter, inarticulate intelligence is only possible through the self endorsed and integrating powers of tacit activity through which particular sensations, sights, or clues are integrated into purposeful focal wholes.

a. Structural Interrelations: Inarticulate Intelligence and Primitive Faculties

But there is yet a further matter that needs to be mentioned in this context. With the rise of higher levels of behaviour, Polanyi suggests, there is a simultaneous intensification of the lower faculties out of which the higher ones evolutionistically arise. The faculties of drive satisfaction and perception, mentioned earlier, are said to be specifically the primordial rudiments of trick learning and sign learning respectively. As the latter two forms of inarticulate intelligence emerge, they tend to enlarge the capabilities of the more primitive faculties. Trick learning, explains Polanyi, "enlarges on innate sensory-motor faculties by grasping of new means-ends relationships", while sign learning "deploys the animal's innate sensory powers in the learning of new sign-event relationships". (P.K., pp. 99, 100) Finally, latent learning, as the highest form of inarticulate intelligence, comprehends the entire order of these faculties<sup>6</sup> and instrumentally employs them for its own higher purposes. In this light, Polanyi, often attributes the superiority of man over animal to "an almost imperceptible advantage in his original, inarticulate faculties." (P.K., p. 69)<sup>7</sup>

3. Articulate Intelligence

a. Language

As we have seen Polanyi's assertions concerning the continuity of intelligence between animals and humans have been quite emphatic. Equally strong however, are his claims regarding "the towering superiority of man over the animals." (P.K., p. 69) This superiority is attributed almost entirely to man's use of language, a matter to which we must now turn to further elucidate. (P.K., p. 70)

The use of language by man, according to Polanyi, accounts for all higher levels of human intelligence. It brings with it what Polanyi calls articulate thought, the basis of which is speech. Along with the rise of language therefore, there occurs a transition from inarticulate to articulate intelligence; furnishing a criterion whereby man is distinguished from animal.

The use of symbols in language, asserts Polanyi, enhance to an almost imperceptible advantage the powers of thought. But, he claims,

In all these instances of the enhancement of our intellectual powers by suitable symbolization, it is clear that the mere manipulation of symbols does not in itself supply any new information, but is effective only because it assists the inarticulate mental powers exercised by reading off their results. (P.K., p. 83)

Here we must observe that just as inarticulate intelligence intensifies lower and more primitive levels of operation, to which it remains bound, articulate thought aids inarticulate powers by heightening the capacity of their performance. While retaining a structural tie with inarticulate intelligence, articulate thought furnishes superior advantages by opening up the potentialities of lower levels of thought. The emergence of language therefore, is complemented by a corresponding intensification of lower faculties.

We must detect an allusion, here, to the original structure of tacit knowing. (P.K., p. 84) As we shall see later, this implies that the achievement of focal attention through articulation depends upon the prior integration of subsidiary elements, which, in this case, refer to inarticulate, sub-linguistic capacities. Hence, the superior powers of articulate intelligence due to the use of symbols "operate ultimately within the same medium of unformalized intelligence which we share with animals." (P.K., p. 82) In this perspective Polanyi can state that "man's gift of speech cannot itself be due to the use of language and must therefore be due to pre-linguistic advantages." (P.K., p. 70)

This characteristic of language is directly related to what is referred to as the "tacit coefficient of speech". The latter signifies the tacit power which achieves an integration between the explicit, articulate component of speech and all that is subsidiarily taken up in linguistic meaning, ie., the subject matter of language. As the meaning subsumed under language increases the operations of the tacit coefficient become more intense. And further, since tacit integration through the active principle involves one's personal endorsement of it, one's personal participation increasingly comes to the fore, as the tacit coefficient of speech engages in greater and more intense acts of integration. Polanyi's reference to the way language describes experience is indicative of such a process as he states:

In order to describe experience more fully language must be less precise. But greater imprecision brings more effectively into play the powers of inarticulate judgment required to resolve the ensuing indeterminacy of speech. So it is our personal participation that governs the richness of concrete experience to which our speech can refer. Only by the aid of this tacit coefficient could we ever say anything at all about experience. (P.K., p. 87)

According to Polanyi "language must be poor enough to allow the same words to be used in a sufficient number of times." (P.K., p. 78) Yet this function can only be fulfilled if utterances have at the same time a definite meaning by being both repeatable and consistent. (P.K., p. 79) For without the latter quality words

would not be identifiable. But,

Since the world, like a kaleidoscope, never exactly repeats any previous situation, we can achieve consistency only by identifying manifestly different situations in respect to some particular feature, and this requires a series of personal judgments. (P.K., p. 79)

Hence, as the use of words is taken to denote manifestly recurring particulars of which they speak, judgments are made that involve a self endorsement and accrediting of such performances. (P.K., pp. 80, 81) The structure of tacit knowing is certainly operative here, and it even comes to sharper view in the further claim that the process of denotation by which particulars are integrated into utterances remains unspecifiable. The "process of applying language to things" is thus ultimately dependent on a personal, unspecifiable act of tacit knowing. (P.K., pp. 70, 84) Denotation then emerges as a skillful art. (P.K., p. 81)

All the preceding characterizations of the denotative process are summed up in what Polanyi calls the principle of "linguistic representation". The latter is presented as an operational principle of language. (P.K., p. 78) However, there is in addition a second operational principle of language, the function of which pertains to "the operation of symbols to assist the process of thought." Our analysis therefore, leads us to a further area of investigation, namely the relationship between language and thought.

#### b. Language and Thought

Polanyi's analysis of articulate intelligence through the use of language is presented as a preliminary step of an inquiry into the nature of thought in general and science in particular. Language is disclosed as a prerequisite for all thought, and consequently for all formalization and systematization. (P.K., pp. 84-86, 101) Through language ordinary thought and science becomes possible. This constitutes the second operational principle of language. With the emergence of articulate thought there is an increasing reliance on this second principle, and a decreasing dependence on the first principle of linguistic representation. (P.K., p. 86)

With the rise of articulate thought, one arrives at the level where explicit knowledge becomes possible. It is the level at which one can explicate various elements in his knowledge, by attending them focally through his capacity of formal conceptualization.<sup>8</sup> The increasing formalization in thought, through increased symbolic manipulations, has yet another consequence. It brings with it a decreasing contact with experience. But concerning the precise relationship between language and thought more must be said.

Polanyi expounds on the relationship between language and thought in his analysis of textual meaning. Prevalent throughout the analysis is the assumption that thought is constitutive of meaning in texts. In this context, Polanyi proceeds to show that in the process of acquiring the message of a text, the words are never focally attended. Their presence in the reading is only a subsidiary one. The reader does not focus on the words, but rather on the message of the text, while being subsidiarily aware of the words, as they support the message in which they are integrated as parts. Moreover, the reader is subsidiarily aware of the words in two respects. First, as they are immediately present in the text supporting the message, and secondly as they relate to all past occasions by which the reader has come to understand the words of the text. (P.K., p. 92) Both are operative in the reading of a text, and in both cases words are attended only subsidiarily.

In this way, the function of words in thought is said to be an instrumental one. Words are the instruments used for a higher focal purpose; hence the reference to language as "the instrument for the tremendous feats of articulation". (P.K., p. 77) In this light therefore, Polanyi states that

the meaning of a text resides in a focal comprehension of all the relevantly instrumentally known particulars, just as the purpose of an action resides in the coordinated investigation of its instrumentally used particulars. (P.K., p. 92)

The subsidiary, or instrumental function of language becomes greatly intensified in the way it operates for the special sciences. In striving for specific scientific skills, explains Polanyi, one seeks to convert the language he has assimilated receptively, "into an effective tool" for handling new scientific subjects. (P.K., p.125)

In view of the preceding analysis, we can now acquire further clarity regarding the nature of articulate thought. Properly speaking, language itself cannot account for articulate intelligence, for it is merely the basis for it. Only the emergence of articulate thought can be explained through language, but not the nature of articulation as such. The primary reason for this is the fact that the focus of all articulation is conceptual, while language plays only a subsidiary role. Furthermore it is only through the focused upon conceptions conveyed by speech that one properly understands speech. If then, articulate intelligence is primarily conceptual with language as its subsidiary foundation, it can be said that

we are aware of language in all thinking (so far as our thinking surpasses that of the animals) and can neither have these thoughts

without language, nor understand language  
without understanding the things to which  
we attend in such thoughts. (P.K., p. 101)

It can thus be asserted that all knowledge on the level of articulate thought displays on the one hand a subsidiary linguistic structure and on the other a focal conceptual structure.

The integration of linguistic particulars into a focal conceptual whole is once again an achievement through the powers of tacit knowing. Particulars are instrumentally brought together as a means to support the focal meaning to which they are jointly coordinated. As in previous cases where tacit power is operative, the integration of particulars to the whole remains an unspecifiable process. For insofar as particulars acquire their status by being known only subsidiarily, any explicit or specifiable tracing of their relation to the whole will inevitably destroy not only the meaning of the whole but the meaning of the particulars themselves. As mentioned before, integral to an act of tacit knowing is also a process of self accreditation whereby acts of knowing are validated in terms of self-set standards.

c. Structural Interrelations: Articulate Intelligence  
and Inarticulate Faculties

Evidently, our analysis has led to the disclosure of increasingly ascending and developing levels of knowing, each of which is integrated with its antecedent levels in accordance with the structure of tacit knowing. From the very primordial and primitive kinds of knowing the tacit structure has been found to consistently hold, by integrating lower subsidiary components into higher focal wholes. At each level of development, it has been shown, occurs a self endorsed tacit assent, whereby the performances at each level are accredited as valid. This has been the case with every level that has been investigated thus far. These levels had included primitive drives and perception, inarticulate intelligence consisting of trick-learning, sign-learning and latent-learning and articulate intelligence consisting of language use and conceptualization in ordinary and scientific thought.

Now with the rise of thought through language on the level of articulate intelligence, one observes the emergence of another pattern with regard to the manner in which the faculties on the different levels relate to each other. At this point it should be noted that the first level of articulate intelligence, made possible through the use of language, is everyday, ordinary thought. The latter entails a descriptive language and methods of establishing everyday facts. The second level of articulated intelligence, characterized by increasing systematization and formalization, is scientific thought. As such, it always remains grounded on the prior level of everyday thought. In this sense, ordinary thought is structurally anterior to scientific thought. (P.K., p. 161)

Furthermore, within science itself one observes a further bifurcation differentiating science into various areas, each of which, like other faculties, holds a relative place in an ascending scale of order. Interesting however, is the fact that the different levels of science appear reminiscent of the three faculties we met on the level of inarticulate intelligence, namely, trick-learning, sign-learning and latent-learning.

Conversely, it can be said that the unbroken continuity between the different levels is such that the lower faculties often reemerge at a higher, more developed stage through the mediating function of a higher faculty. Polanyi claims that

Our three types of animal learning are primordial forms of three faculties more highly developed in man. Trick-learning may be regarded as an act of invention; sign-learning as an act of observation; latent learning as an act of interpretation.  
(P.K., p. 76)

So, the three faculties of inarticulate intelligence are presented to foreshadow three higher human faculties respectively. Through the use of language each of the three faculties develops as a distinct science. The faculty of invention as a product of scientific thought is comprised of "ingenious and useful operations of the kind that are described in patents and form the subjects of engineering and technology." (P.K., p. 76) That of observation includes the entire range of natural sciences. Experimentation and the process of induction appear to be the main features of this scientific area. Finally, the development of latent-learning to interpretation as its articulate counterpart "will comprise a system of logic, together with the elements of mathematics and classical mechanics." (P.K., p. 76) It is also pointed out that the highest forms of this kind of articulate intelligence are mathematics, logic and mathematical physics, the methods of which proceed according to the principles of deduction.

This then completes the pattern that emerges in the continuous development of faculties from the lower primordial levels to at least the higher level of scientific thought.<sup>9</sup>

#### 4. Intellectual Passion

##### a. General Remarks

In identifying the various levels or modes of knowing preceding scientific thought, we also mentioned the role of the active principle. The latter was examined in relation to the most primitive faculties of drive and perception and was found to play a determinative part in both orienting the faculties towards their respective goals and confirming their self satisfaction.

in fulfilling their wants. It was also pointed out that the active principle, evident already in animal life, prefigures all intellectual strivings of man. Hence, as we now ascend to the level of articulate thought in general and science in particular, we should expect to detect traces of the active principle, if not in its original form, at least in some transformed manner resembling its original operation in the primitive faculties. With these preliminary remarks in mind we can now turn to an initial examination of the inner processes of articulate intelligence in general.

According to Polanyi's perspective all achievements of all intellectual strivings, whether animal or human, are accompanied by strong experiences of joy, pleasure and delight. Examples of such pleasure are evident in animals when they repeat manipulative functions they had once invented for some practical end, for the mere purpose of playful joy. As one strives for satisfaction on higher levels of development the pleasure received increases proportionately. The joy for instance, acquired by humans in making a scientific discovery exceeds far beyond animal pleasure acquired through manipulative play (P.K., p. 133) These intellectual strivings and the increasing joys they offer, as one ascends to the level of science, Polanyi calls "intellectual passions".

Since scientific pursuits are characterized by intellectual strivings, it follows that intellectual passions would in some respect enter into the inner nature of scientific practice. Polanyi asserts that "The affirmation of a great scientific theory is in part an expression of delight." (P.K., p. 113) It is suggested that intellectual passions are an indispensable ingredient of science, which as such enter into the claim that a certain theory represents reality. This presupposes that intellectual passions are not only unavoidable, but they can be correct or incorrect, as they take part in the endorsement of what is taken to be real. In this light, science, on account of its passionate dimension, is placed on a par with other cultural provinces. It "finds its place among the great systems of utterances which try to evoke and impose correct modes of feeling." (P.K., p. 133) In terms of its passion-forming capacities, science is thus placed next to art, religion, morality, law and all the other areas of culture. For Polanyi therefore, intellectual passions acquire fundamental importance for science itself as well as for the place and operation of science within the fabric of human culture. His concern in this becomes evident as he states:

Science can then no longer hope to survive on an island of positive facts, around which the rest of man's intellectual heritage sinks to the status of subjective emotionalism. It must claim that certain emotions are right; and if it can make good such a claim, it will not only save itself but sustain by its example the whole system of cultural life of which it forms a part. (P.K., p. 134)

But for a more precise exposition of the function of passions in science further elucidation is required.

b. Three Functions of Intellectual Passions

i. The Selective Function

Polanyi points to historical instances where scientists, in the face of having made a discovery, responded by intense emotional outbreaks. In announcing the discovery of one of these laws, Kepler was quoted to have uttered "...nothing holds me; I will indulge my sacred fury..." (P.K., p. 134) This and many other instances are cited as examples of the first function of intellectual passions presented in science.

From the outset it is stated that,

The excitement of a scientist making a discovery is an intellectual passion telling that something is intellectually precious and, more particularly, that it is precious for science.

Passionate expressions in science, claims Polanyi, are not statements of fact. But neither are they personal psychological by-products. Rather, their function is to assert the scientific interest in certain facts, namely, the facts that the scientist has discovered. They affirm that such facts are of immense value to science. They assess the importance of such facts as they foreshadow a whole range of future discoveries which are of yet indeterminate. This aspect of scientific passion is granted the task of "distinguishing between demonstrable facts which are of scientific interest and those which are not." (P.K., p. 135) Out of the thousands of facts that are knowable, it chooses the ones that are meaningful for scientific consideration. Precisely for this reason it is referred to as "the selective function of intellectual passions." (P.K., p. 142)

Polanyi himself recognizes that his insistence upon the presence of passions in science radically differentiates him from the traditional view of science as objective, devoid of emotions or feelings. (P.K., p. 134) His position rivals the notion of objective science even further, when in view of the selective function of scientific passions, he declares that science must necessarily accept an antecedent, "pre-scientific" interest in its subject matter. (P.K., p. 139) <sup>10</sup>

ii. The Heuristic Function

In addition to the selective function, Polanyi introduces the so-called "heuristic function of scientific passion". Its

operation is to "evoke intimations of specific discoveries", while sustaining the pursuit of such discoveries, in many cases throughout years of labour. (P.K., p. 143) At this point, the selective passion, determining scientific value, merges with the capacity for discovering it through the heuristic passion. All authentic scientific discoveries originate from the heuristic function of scientific passions. It guides and sustains the creative scientist in his attempt to hit upon the correct answer. The heuristic passion urges the person to cross a gap; the gap that lies between a problem and its solution. The crossing of such a gap involves a certain modification of one's framework achieved by an irreversible, or unrepeatable activity. For one cannot repeat a process of discovery, when what is sought has already been found. (P.K., pp. 143,75) Through such a discovery something new is added to one's framework, with the consequence that he will "never see the world again as before". Although discoveries are made in terms of a person's framework, they at the same time demand its alteration. The process of scientific discovery therefore, cannot be specified in terms of a fixed framework from which to proceed. There is a gap here, that can only be overcome by the heuristic function of scientific passions, which itself is unspecifiable. Heuristic passions therefore, are the impulses out of which originality is born. Polanyi states it in this way:

Like all ventures in which we comprehensively dispose of ourselves, such an intentional change of our personality requires a passionate motive to accomplish it. Originality must be passionate. (P.K., p. 143)

### iii. The Persuasive Function

When a genuine discovery is made through the heuristic passion, claims Polanyi, it must be shared. For to the extent to which a person commits himself to what he has discovered as being genuinely true, he will hold his discovery with universal intent. He will and must present it as a token of reality that others must recognize and acknowledge. It is therefore, indispensable that he convinces others to share and accept his new finding. This urge that compels a person to convict others of the universal validity of his own discovery Polanyi calls the "persuasive passion". (P.K., p. 150)

Just like the heuristic passion, the persuasive passion too is faced with a gap that must be crossed. The alteration of one's framework that comes with the assimilation of a new discovery simultaneously results in the creation of a gap between the discoverer and all those committed to the old ways. In accordance with the compulsions of the persuasive passion, the latter must be convinced of the new discovery. Failure to do so will be detrimental to the discoverer as well as to his discovery. The

new world that the discoverer discloses must either become accepted or else it will disintegrate. For, as Polanyi claims, "a general unbelief imperils our own convictions by evoking an echo in us. Our vision must conquer or die." (P.K., p. 150)

In this context the whole problem of scientific controversies falls under a new light. Polanyi suggests that

scientific controversies never lie altogether within science. For when a new system of thought concerning a whole class of alleged facts is at issue, the question will be whether it should be accepted or rejected in principle, and those who reject it on such comprehensive grounds will inevitably regard it as altogether incompetent and unsound. (P.K., p. 150)

Furthermore, the gap that exists between two conflicting systems is such, that no formal operations from one framework can demonstrate the validity of its own system to a person adhering to another framework. (P.K., p. 151) Neither can one convince an opponent, by formal argumentation from within the opponent's system. For in such a case, the opponent will never be confronted with the compulsion to abandon in principle his entire system. Demonstration, claims Polanyi, must be supplemented by "forms of persuasion which can induce a conversion." (P.K., p. 151) The proponent of a new system must first win the intellectual sympathy of his hearers. And the gap can only be crossed by the spur of the persuasive passion, which is itself an unspecifiable act, through which others are called upon to give allegiance to a new framework.

### c. Intellectual Passions as Integrators

Our examination of the three functions of intellectual passions and the intimate relation they have with science has shown that they are of crucial importance. A final remark however, needs yet to be made in order to complete the systematic relation which holds between intellectual passions and the other main components we mentioned in Polanyi's thought.

In the first place, it should be noted that intellectual passions are not related to science as an additional faculty in the ascending levels of knowing. They are not a faculty adjacent to that of science. Neither should the three functions of intellectual passions be confused with any three levels of intelligence. Intellectual passions belong to a different sort of order than the one we met in analyzing the development of faculties on various levels. They are however related to the latter. And this relationship is akin to the way the active principle relates to drives and visual perception. It is a relationship, between root and branches, as it were, rather than between branches themselves. What the active principle achieves on the primitive levels,

intellectual passions achieve on the more sophisticated levels. They both provide their respective faculties with an integrating orientation in accordance with self-set standards, which proves to be imperative for the very operation of these faculties. In this respect, it can be said that there is an unbroken continuity between the active principle and intellectual passions. This comports well with Polanyi's evolutionistic perspective, which will be scrutinized closely later on. It can even be stated that intellectual passions are nothing other than the operations of the active principle on a higher level of development.

From the preceding analysis we can now see how all three intellectual passions operate as a necessary background out of which science proceeds. The selective, heuristic and persuasive passions are thus disclosed as the proper context within which scientific activity is guided and oriented to its goals.

### C. Commitment I

#### 1. The Context

However, the exposition of both the active principle and intellectual passions is not for Polanyi an end in itself. In his Personal Knowledge the entire analysis follows a pattern in which the active principle, as well as intellectual passions are presented as a prelude to another matter, which is for Polanyi a more fundamental concern. His analyses of those two principles are intended to provide a channel for an exposition of the role of personal commitment in human knowledge.

Already in our analysis of the active principle and intellectual passions we referred to certain key characteristics that can be taken as allusions to active processes involving commitment. The primordial strivings on the level of drives and perception, as well as the intellectual strivings in ordinary thought and science disclosed a self compelled dynamic urge to search for and achieve self satisfying goals. They exhibited a kind of purposeful commitment, as it were, which attached their respective faculties to self fulfilling ends. In the subsequent chapter we shall examine in a rather explicit fashion the function of commitment, which, though it can only be understood, in Polanyi's view, in personal terms, furnishes an indispensable component of knowledge including science. Such a position, as we shall see, places Polanyi's conceptions at variance with the dominant views of modern philosophy.

Polanyi embarks on his investigation of the function of commitment in the context of an attack against the modern intellectual tradition. He articulates his own position in rivalry to that predominant trend of modern thought, in which modern science was given birth. To be more precise, it is the tradition inaugurated by Descartes; the tradition which culminated in the philosophy of Positivism. Polanyi refers to the entire history of this

movement as the tradition of "critical philosophy". It is indeed, according to Polanyi, a philosophic tradition that attempts to ground all truth in a methodical process of intellectual doubt. (P.K., p. 269) In this tradition the title of 'true knowledge' can only be ascribed to whatever endures the rigorous and impartial test of rational critique. By establishing critical reason as the sole arbiter of truth, this tradition seeks to secure knowledge while cleansing itself from the dogmatic blunders of the past. Its redemptive program leads to a differentiation of all that men have hitherto held as 'true' into two mutually exclusive spheres. It distinguishes true knowledge from mere dogmatic opinion, rationally demonstrable knowledge from groundless belief. (P.K., p. 266) Reason and faith are conceived as irreconcilable opposites, with the former as the exclusive and absolute source of all true knowledge.<sup>11</sup>

Precisely at this juncture of modern thought Polanyi raises his objections. And this must be kept in mind throughout our entire analysis. Polanyi's rivalry against the modern intellectual tradition aims directly at those very issues that granted this modern trend its distinguishing marks. For what could describe more accurately the modern intellectual tradition than the 'religious' compulsion to ground all knowledge in rationality?

## 2. General Remarks

For Polanyi the attempt to secure human knowledge on the basis of critical reason is not only an impossibility, but it is also destructive, for it runs contrary to the very nature of human knowing. His rather articulate exposition of an alternative avenue is colored by his plea to acknowledge "belief once more as the source of all knowledge." (P.K., p. 266) Of all the historical figures mentioned St. Augustine is presented as the foremost proponent of the 'new' way. According to Polanyi,

In the fourth century A.D., St. Augustine brought the history of Greek Philosophy to a close by inaugurating for the first time a post-critical philosophy. He taught that all knowledge was a gift of grace, for which we must strive under the guidance of antecedent belief. (P.K., p. 266) <sup>12</sup>

As we shall see this is in principle the route that Polanyi himself intends to follow.

It is stated that all knowledge proceeds out of a vision of reality upon which one ultimately relies for the certainty of what he knows. Such a vision furnishes the necessary fabric, or framework within which all human knowing is conducted. All intelligence however original, or critical, must operate within the boundaries provided by this framework. Moreover, its function in human knowing rests on being a-critically accepted on the basis of commitment; acknowledging its worth as a true source of knowledge. Acceptance of such a framework is hence "the condition for having any knowledge". (P.K., p. 267)

Yet, Polanyi makes sufficiently clear that one's vision of reality can claim no self-evidence. An interpretive framework is constantly modified and enlarged. It can often lead to a misconstrued interpretation of experience rendering the most obviously true beliefs difficult to hold. Though one's most fundamental interpretive propensities are innate, the attempt to strictly specify the assumptions they embody is for Polanyi an impossibility. Their validity can never be explicitly demonstrated in a self-evident manner. "Our mind", he states, "lives in action, and any attempt to specify its presuppositions produces a set of axioms which cannot tell us why we should accept them." (P.K., p. 267)

By refusing to talk of ultimate beliefs as self-evident truths however, Polanyi does not intend to reduce fundamental convictions to the status of mere relativity and arbitrariness. As ultimate convictions, they retain an indubitable character. But the certitude ascribed to them is ultimately justified by a person's commitment in accepting them as ultimate assumptions; by submitting to them in allowing them to function as ultimate directives in all acts of knowing. For Polanyi, "Our basic beliefs are indubitable only in the sense that we believe them to be so. Otherwise they are not even beliefs, but merely somebody's states of mind." (P.K., p. 267)

Here we encounter once again a glimpse of that peculiar characteristic of tacit knowing, which we also found in both the active principle and intellectual passions. We are referring to the personal endorsement of self-set standards held with universal intent. As we shall see, the general nature of commitment with respect to ultimate beliefs will be found to exhibit a close affinity with the structure of tacit knowing. This will become immediately evident as we proceed with a more detailed exposition of the nature of commitment.

### 3. The Nature of Commitment and Tacit Knowing

Man so identifies himself with his ultimate beliefs, asserts Polanyi, that he dwells in them just like he dwells in his own body. (P.K., p. 60) Properly speaking, a person uses a framework if he dwells in it and interprets out of it. A framework finds its legitimate employment as its user functions from within it. Only if these requirements are met can something be properly identified as a framework. This implies that in its primary meaning it is neither to be observed nor handled, but to be relied upon. (P.K., pp. 195, 196)

If the nature of the framework is understood in this manner, any attempt to secure its validity through strict rational demonstration will emerge not only inadequate, but will also undermine its proper nature. For to try to establish the reliability of a framework by analytically scrutinizing it is to deprive it

of the scope of its proper purpose. In such a case, one will be reducing it from something out of which rational analysis proceeds, to something at which analysis is directed. Polanyi is convinced that a strict demonstration of ultimate beliefs can never be fully satisfying, not even for the person who adheres to them. "The curious thing", he claims, "is that we have no clear knowledge of what our presuppositions are and when we try to formulate them they appear quite unconvincing." (P.K., p. 59) The acceptance of a framework is necessarily an uncritical one. A person adheres to a framework as he accepts it by relying upon it, and not as he confronts it critically. In fact, it is his dependence upon a framework that enables him to be critical and not vice-versa. He depends upon a framework in order to be critical. He cannot be critical in order to submit to a framework. It should be understood, however, that this does not mean that a person cannot look at his own ultimate beliefs critically. What it does mean is that ultimate assumptions cannot be established as universally valid solely on the basis of critical investigation.

Polanyi goes a step further. He posits that when ultimate beliefs are considered in terms of their primary nature and essential operations, they cannot even be asserted. According to Polanyi, articulate assertions can be made only if a framework is presupposed. The framework as such cannot be the subject of an assertion. Assertions can be stated only within a framework, which alone can grant them their intended meaning. Insofar as certain beliefs are accepted for a time, and adhered to, they must in the first place function as a background orientor providing a context of meaning in which stated assertions can make sense. On this matter Polanyi says the following:

When we accept a certain set of pre-suppositions and use them as our interpretive framework, we may be said to dwell in them as we do in our own body. Their uncritical acceptance for the time being consists in a process of assimilation by which we identify ourselves with them. They are not asserted and cannot be asserted, for assertion can be made only within a framework with which we have identified ourselves for the time being; as they are themselves our ultimate framework, they are essentially inarticulable. (P.K., p. 60)

Here again, the crucial point is not so much that basic beliefs cannot be articulated and formally declared, but rather, that they cannot be established, as such, merely through stated assertions. A formal specification of ultimate beliefs can only furnish a set of axioms. But it cannot provide a reason as to why they should be accepted (P.K., p. 267) Consequently, the a-critical attitude in which beliefs are

accepted, as well as their basically inarticulable nature appear to place beliefs outside the realm of formal testing. The test of proof or disproof is thus irrelevant for accepting or rejecting basic beliefs. For this reason, Polanyi claims that "all fundamental beliefs are irrefutable as well as unprovable." (P.K., p.271)

From the preceding analysis, certain conclusions concerning the nature of beliefs press themselves to the foreground. It appears that in principle, basic beliefs do not function overtly. Their proper operation in human knowledge is implicit rather than explicit; they appear in the background. (P.K., pp. 252, 287) In other words, to use Polanyi's terminology, frameworks and beliefs have in essence a subsidiary function in human knowledge. When considered from the vantage point of their essential nature, they cannot be the subject of explicit scrutiny, i.e., of focal attention. In a fundamental sense they retain a subsidiary status. To treat ultimate beliefs as if they can be reduced to items of focal attention is to undermine their proper nature. Moreover, nothing can be focally attended apart from the subsidiary operation of held beliefs. In fact, the framework provided by accepted beliefs sets the grounds upon which different realities can be noted and understood. They furnish the subsidiary foundation from which one can focally attend to things. And it is precisely in this from-to relationship that beliefs find proper place.

Once again, the structure of tacit knowing comes to the fore. It should be remembered that from the very beginning of our analysis the structure of tacit knowing has been found to comprehend a subsidiary and a focal component. It was also noted that the two components complemented each other, as subsidiary particulars were integrated into a focal center; as subsidiary parts provided the ground from which other items received focal attention. Similarly, the function of beliefs or frameworks can be compared to the subsidiary aspect of tacit knowing. The reliance upon a framework for interpreting a specific reality is akin to the dependence upon subsidiary particulars for attending a focal center. Hence, implicitly functioning beliefs are to explicitly disclosed assertions, as subsidiary functioning particulars are to focally attended entities.

As one level of human knowing, Polanyi claims, science too incorporates within its own constituent nature a certain set of beliefs. They provide the framework out of which the scientist makes sense of his field of investigation. He accepts certain scientific presuppositions by assimilating them into himself, as part of his own being; he identifies himself with them as he does with his own body. (P.K., p. 61)

Polanyi compares the operation of a framework with the

use of a tool. (P.K., p.60) It is said that in using a tool one assimilates it as an extension of his own body. In doing so, one uses the tool trusting that it is capable of achieving the purpose for which it is employed. Its user relies on it as a means to the specific end he has in mind. Eventhough the tool may in fact fail to achieve its purpose, at the time of its use it is entrusted with the capacity of doing so. Similarly, frameworks are entrusted to lead to certain desirable ends. They are relied upon for achieving focal purposes. One counts upon a framework with the assurance that it provides a reliable ground from which purposeful ends can be pursued. It is taken as a trustworthy point of departure from which a scientist can focus on a vast number of items. Thus, just like tools, beliefs exhibit an instrumental character. They are the instruments in terms of which certain ends are achieved. (P.K., pp. 60-62)

Here again the relationship between beliefs and their ends is reminiscent of the original structure of tacit knowing, in particular, the relationship between subsidiary particulars and their focal center. For as we saw earlier, subsidiary parts are integrated into a focus as instruments in the service of some purpose. The implicit operation of frameworks in human knowledge appears to function in precisely the same manner. As we shall see in our subsequent analysis, the dependence on a framework as a means to an end underlies the entire process of scientific discovery.

#### 4. Personal Knowledge

But there is more to be said concerning the affinity of beliefs with tacit knowing. The way in which subsidiary elements and their focal purpose receive integration into one another has been found to be ultimately unspecifiable. (P.K., p. 62) Furthermore, it was concluded that such an integration could only be achieved through a self endorsed act of tacit knowing, which itself had the power to accredit correlations between particulars and a common purpose. Likewise now, implicit beliefs bear an unspecifiable relationship to the focal ends for which they are intended. Yet, subsidiary beliefs are held precisely because they are taken to be integral to their anticipated purposes. According to Polanyi, the integration of a framework with the particulars it comprehensively points to can only be achieved by a personal self accredited act, in which the knower freely submits to the framework as a reliable instrument capable of bringing about a purposeful focal integration. In principle, we are here confronted with an act of tacit knowing, which is now transposed into a personal commitment; a commitment in which a subsidiary framework and its focal ends are integrally held together. Just like a person relies on a tool by committing himself to the tool's capability for achieving desired ends, so also a person commits himself to his beliefs acknowledging that they are bound to meaningful ends. In Polanyi's words: "This reliance is a personal commitment

which is involved in all acts of intelligence by which we integrate some things subsidiarily to the centre of our focal attention." (P.K., p.61)

Evidently it is observed that the requirement for personal commitment in assessing and establishing integration between subsidiary beliefs and focal ends demands the personal judgement of the knower. It becomes imperative that he personally involves himself in what he comes to know. He thus personally participates in and contributes to his own knowledge. The integration of subsidiary elements into a focus, as in the case of using a tool for an intended purpose, or assimilating a framework for focusing on specific meaning, betrays this intimate involvement of the knower. Without personal commitment knowledge is impossible, for the tacit structure of knowing disintegrates, as subsidiary elements and their common focus dissolve into disjointed components. In this light, it can thus be said that all knowledge is personal knowledge. And scientific knowledge, which is Polanyi's fundamental concern, is no exception.

Yet, a person does not commit himself to meaningful purposes of his own framework as the result of an arbitrary subjective exercise. He commits himself precisely because in doing so he believes to be hitting upon the truth which, as such, he respects and adheres to with universal intent. Polanyi states that

We can assimilate an object as a tool if we believe it to be actually useful to our purposes and the same holds for the relation of meaning to what is meant and the relation of the parts to a whole. The act of personal knowing can sustain these relationships only because the acting person believes that they are apposite: that he has not made them but discovered them. The effort of knowing is thus guided by a sense of obligation towards the truth: by an effort to submit to reality. (P.K., p.63)

## 5. Framework Modification

Polanyi employs the term 'framework' in a number of ways. By it he does not only refer to the subsidiary aspect of conceptual knowledge, but also to the subsidiary component of perceptive knowledge and even appetitive knowledge. Thus on each level of knowing one finds a corresponding framework in terms of which the different faculties are focally oriented towards their end. It is a process by which they strive for self satisfaction on the basis of self-set standards. By subsidiarily relying on their accepted frameworks they display a power of anticipation in an attempt to gain sharper focus on

whatever appears to fulfill their standards. What is most characteristic about this power is its capacity to identify new instances of things already known on the various levels. In doing so, the different faculties are enabled to strive towards increasingly self satisfying states. But as Polanyi's concern lies primarily with conceptual frameworks, and the anticipatory powers they elicit, he speaks about them in the following manner:

The power of our conceptions lies in identifying new instances of certain things that we know. This function of our conceptual framework is akin to that of our perceptive framework, which enables us to see ever new objects as such, and to that of our appetites, which enables us to recognize ever new things as satisfying to them. It appears likewise akin to the power of practical skills, ever keyed up to meet new situations. (P.K., p. 103)

However, this anticipatory power of a conceptual framework can only execute its task as it is coupled with an additional capability that stands in direct correlation to it. It is the capacity of re-adaptation in the face of novel situations. One's anticipatory powers must always occur jointly with a re-adaptation of the framework out of which the anticipating process itself takes place. The ability to re-adapt becomes an imperative requirement when viewed in the light of Polanyi's belief in "the unceasing changes which at every moment manifestly renew the state of things throughout the world." (P.K., p. 103) Thus, "every time our existing framework deals with an event anticipated by it, it has to modify itself to some extent accordingly." (P.K., p. 103) This holds true on all levels of knowledge.

It has been previously pointed out that thought presupposes language, while the latter functions in thought as its subsidiary supporter. As words are held to have a determined meaning, one anticipates to meet new instances of such meaning by being aware of the words subsidiarily, while focusing on the newly emerging realities. But, claims Polanyi, since no two instances of the same meaning are strictly identical, the employment of words to a new situation requires that the words be modified to a certain degree. They must adapt and assimilate new elements in such a way so as to support a newly formed conception, as they focus upon the novel elements of a new situation. For example, the use of the word "owl" in designating the nature of a bird that appears to someone, does not only say something about the nature of the bird he is observing. It also says something new about the term "owl" in its general meaning. (P.K., p. 110) What is crucial, however, is that the re-adaptation of one's framework occurs through the manipulation of particulars on the subsidiary level. The ability to anticipate new instances of meaning within a framework through

focally attending new conceptions simultaneously entails a subsidiary groping, whereby linguistic meaning is altered to sustain the new conception. Through this process one's framework is constantly re-adapted as new subsidiary linguistic meanings and focal conceptual meanings are assimilated into the old framework. In such a context, therefore, the anticipatory power emerges as a striving from the subsidiary components to the new focus, while the re-adaptive power appears as the coordinating rearrangement of the subsidiary particulars by the newly discovered focus. These dual and complementary aspects of the relation between the subsidiary and focal elements is nothing other than the functional and phenomenal structure of tacit knowing. (T.D., pp. 10, 11) It should also be added that since the integrating function in such a process is tacit, the modification of one's framework remains ultimately unspecifiable.

Furthermore, the basic structure of framework-modification, as expounded above, must be understood as a process that takes place on all levels of knowing, from the most primitive to the most developed. Polanyi puts it as follows:

The adaptation of our conceptions and of the corresponding use of language to new things that we identify as new variants of known kinds of things is achieved subsidiarily, while our attention is focussed on making sense of a situation in front of us. Thus we do this in the same way in which we keep modifying, subsidiarily, our interpretation of sensory clues by striving for clear and coherent perceptions, or enlarging our skill without focally knowing how by practicing them in ever new situations. The meaning of speech thus keeps changing in the act of groping for words in this manner with a fund of unspecifiable connotations.

In this perspective therefore, Polanyi proceeds to define language, as "the product of man's groping for words in the process of making new conceptual decisions, to be conveyed by words." (P.K., p. 112)

## 6. Subsidiary Components and Frameworks

At this point we should bring to our attention the fact that there is a close connection, at least on the level of conceptual knowledge, between language and pre-linguistic, inarticulate behavior on the one hand, and frameworks on the other. It has been pointed out already that in terms of the ascending levels of the various faculties, inarticulate intelligence, and language in particular furnish the subsidiary foundation for focal, conceptual knowing. In view of having

explained frameworks as a subsidiary component of conceptual thought, the question is now raised as to whether there is an identity between frameworks and pre-conceptual levels of functioning. Evidently this is precisely what Polanyi does.

Throughout his entire analysis on the re-interpretation of language, he constantly shows how the meaning of conceptual knowledge is deeply ingrained in the medium of language and inarticulate understanding as sub-conceptual levels of awareness. (P.K., pp. 108, 109, 112, 113, 115, 287) In this context, conceptual meaning sustained by language appears as the immediate, subsidiary framework of articulate comprehension, followed by less sophisticated inarticulate frameworks, in which the subject matter of what is conceived is pre-conceptually understood. In their own way, all these subsidiary levels contribute to articulate, conceptual comprehension; they provide the framework from which things are articulately conceived

From this vantage point, the modification of a framework emerges as a more complex transition than one might initially think. For it entails a corresponding shift on all pre-conceptual, subsidiary levels, coupled with a re-adjusted integration, by which they provide the prerequisite support for bringing into focus new conceptual meaning.

This brings us to another important matter. Having established a close connection between frameworks, or beliefs and dependence upon subsidiary levels of behavior, one is led to yet another significant conclusion, namely, that whatever functions as a relied-upon subsidiary operation, also functions as a framework, as a belief upon which one proceeds. This in fact is the assumption underlying Polanyi's reference to conceptual, perceptive and appetitive frameworks. (P.K., p. 103) Such an identification of a person's dependence on subsidiary levels of operation and beliefs can be further elucidated in terms of additional specific features of the structure of tacit knowing. When certain items are used subsidiarily in an instrumental manner, they are entrusted from the outset with certain capacities. In the first place, they are relied upon in being able to sustain one's focal attention for a certain purpose. Furthermore, their usage and employment occurs in the expectation that they would, indeed, lead to and focally disclose ever new aspects of reality. (P.K., p. 104) The point at stake here is that by submitting to subsidiarily functioning elements, through such expectations, a person adheres to them as a given framework; he trusts them as he proceeds out of them reaching for satisfying consequences. Hence the subsidiary, instrumental acceptance of any item or operation is simultaneously raised to the status of a belief. And as we saw, the integration of subsidiarily relied upon elements to a center of focal attention is ultimately achieved by a tacit act of personal commitment.

## 7. Commitment in Framework Modification

We have seen that the process of framework modification involves a development in which the subsidiary and focal components mutually influence one another due to their interpenetrating correlation. Commitment therefore, as the original integrator of the two components, inevitably enters the process of modification. Through its tacit operations, personal commitment endorses the manner in which a framework must correlate with anticipated novelties. It accredits the validity of their relationship at every step along the way. Without the dimension of commitment, the process of modification would fall apart, for it alone can hold subsidiary assumptions and focal intentions together.

The manner in which commitment proceeds, while attempting to gain increasing knowledge, is akin to the way both the active principle and intellectual passions have been found to orient one's strivings on lower levels of development. Commitment follows the path of a series of judgements which are appraised according to self set standards. It legislates these standards as criteria to be fulfilled through the ongoing process of modification. Through them, one's personal commitment provides the self accredited, striving impetus for greater clarity, comprehension and satisfaction, even to the point of inducing alterations in his framework. In this sense Polanyi speaks of the educated mind striving "continually to enrich and enliven its own conceptual framework." (P.K., pp. 103, 104) It is a process through which a person seeks increasing intellectual self satisfaction.

We should note however, that Polanyi's formulations concerning the personal setting of standards through commitment are accompanied throughout his Personal Knowledge with certain remarks which betray an attitude of cautiousness. Polanyi seems to be very careful lest he be accused of total subjectivism. He indicates that "this urge to satisfy ourselves is not purely egocentric." (P.K., p.106) Neither is it accidental or arbitrary. But rather, it is an attempt to increasingly come to grips with reality, and such an attempt embodies intentions that surpass mere egoistic satisfaction. For what is taken to be reality is held as being universally valid. As Polanyi states,

We seek self-satisfaction here only as a token of what should be universally satisfying. The modification of our intellectual identity is entered upon in the hope of achieving thereby closer contact with reality. We take a plunge only in order to gain a firmer foothold. The intimations of this prospective contact are conjectural and may prove false, but they are not therefore mere guesses like betting on a throw of dice. (P.K., p. 106)

Nevertheless the judgements made remain one's own, while what is taken to be reality is granted authority over one-self. It is therefore "subjective self-confidence in claiming to recognize an objective reality." (P.K., p.104) There is obviously an apparent paradox here, which Polanyi himself very clearly recognizes. On the one hand, there is a claim to objectivity, while the objectivity itself is accredited in terms of self set standards. We will not at this point expound upon the decisive solution that Polanyi gives to this problem. At this stage of our analysis it will suffice to point out that in the course of framework modification we find the knower participating in his knowing process through a self accredited tacit commitment.

Finally, the process of self accredited modification is for Polanyi a heuristic one. As such it is an irreversible activity endowed with the power of originality. Once a framework becomes modified through commitment there is no return, for the person will henceforth see the world in a new way, incomparable with all his previous experiences. Insofar as we are talking about articulate intelligence, it is indeed a transformation of one's intellectual life. But its occurrence in the context of personal commitment assures the knower that any such change is for the good. For it takes place through the medium of the conviction that each alteration results in an increasing proximity to the truth. As this pattern displays itself on the various levels of activity, Polanyi explains that

any modification of an anticipatory framework, whether conceptual, or appetative, is an irreversible heuristic act, which transforms our ways of thinking, seeing and appreciating in the hope of attuning our understanding, perception and sensuality more closely to what is true and right. (P.K., p. 106)

We thus obtain a picture of constant change, modification and re-adaptation. It indeed reflects Polanyi's preference for an evolutionistic perspective, where all cosmic processes, as we shall see later in greater detail, are ultimately subjected to a "universal biological adaptivity." (P.K., p.124) We therefore find the universal intent of personal commitment couched in an ongoing developmental setting of constant transformation.

## 8. Intellectual Passions and Commitment

For systematic clarity we must at this juncture make a few remarks concerning the relationship between commitment and intellectual passions. According to Polanyi, all of life is endowed with originality as it proceeds in encountering and assimilating a vast range of novelties.

(P.K., p. 124) On the higher stages of development, such as the level of inarticulate and articulate intelligence, originality was found to come to specific expression through intellectual passions, in particular through their heuristic function. Just like the active principle on the primitive stages, intellectual passions provided their respective faculties with the power to integrate subsidiary particulars into focal purposes. Interestingly enough, however, the structure of commitment has been found to share these features as well. Among other things, it too furnishes the principle of integration, in which subsidiarily accepted entities and focal intentions are united. To this extent therefore, one observes a close affinity between intellectual passions and commitment.

In commenting about scientific discovery, Polanyi describes the personal initiative of the scientist through his commitment as "invariably impassioned, sometimes to the point of obsessiveness." (P.K., p.301) He is quite emphatic about the fact that one's personal participation in the knowledge he believes to possess "takes place within a flow of passions." (P.K., p. 300) As we shall subsequently see in greater detail, these passions, and specifically their heuristic aspect, become a determining force through which scientists make their choices in the process of scientific research. But, says Polanyi, "Within the framework of commitment this determining force reappears now as a sense of responsibility exercised with universal intent." (P.K., p. 310) The continuity therefore, between intellectual passions and personal commitment becomes rather evident. The operation of heuristic passions through their self-set standards appears to be transformed into a commitment of responsibility held from the vantage point of an obligation towards what it considers to be universally valid; a commitment held with universal intent. Such a continuity is further exemplified in Polanyi's repeated reference to the personal involvement of the knower as a "heuristic commitment." (P.K., pp.311, 316) But the unbroken flow of passions into commitment becomes truly uncovered when Polanyi alludes to their continuity in the reverse direction. This becomes evident as he unhesitantly speaks of the presence of commitment not only in animal activity, but even on the most primordial level of vegetative, organic life. (P.K., pp. 363, 367)

It can thus be said that just like the active principle, as the tacit integrator on the primitive level, was found to be continuous with intellectual passions, so also, these passions appear to be continuous with commitment on higher stages of development. Essentially, this phenomenon depicts the recurrence of the original principle of tacit integration on a series of ascending levels of evolutionary development. And as we shall see, this will provide

the general matrix within which Polanyi develops his theory of science.

#### D. Science: Discovery and the Logical Gap

##### 1. Problem Solving

We have seen that Polanyi rejects the idea of critical reason as the ground of knowledge, while asserting that the legitimate foundation of all knowledge is personal commitment. It was also pointed out that such a commitment entails an a-critical submission to a subsidiary framework of ultimate beliefs, upon which focal awareness relies for the acquisition of knowledge. Moreover, we alluded to the fact that commitment discloses its presence in a continuous way on a variety of levels, from the most primitive vegetative level to the higher intellectual behavior of man. But now this fact implies that scientific activity, as a human intellectual process, would in some way be intercepted by this continuous presence of personal commitment. More specifically, one would expect that personal commitment would disclose itself in scientific activity in terms of its original tacit structure. The analysis that follows will center on how the tacit structure of personal commitment becomes operative in the process of scientific discovery.

There is no fully awake animal, states Polanyi, that escapes the purposive tension of readily perceiving and acting, in an attempt to make sense of its own situation. Through its involvement in this goal oriented, but also strenuous process, the animal seeks to control itself as well as its own environment. The phenomenon of problem solving is continuous with and arises out of such strivings. It too, aims at making sense of a situation by retaining control. As the animal attempts to achieve this balanced control between itself and its surroundings, its problem solving effort differentiates into two distinct stages. There is "the first stage of perplexity, followed by a second stage of doing and perceiving which dispels this perplexity." (P.K., p. 120) These two stages are intrinsic constituents of all problem solving, as it occurs in both animals and humans.

A problem is said to be noted if its perplexity endures for some time, while inducing the animal or person to a genuine search for its solution. The problem at hand must be acknowledged as a real one. A preoccupation with a problem, therefore, is authentic to the extent to which it imposes upon a person an emotional strain sought to be eliminated by the discovery of a solution. Dispelling a perplexity is usually accompanied by great joy as a result of relieving

the initial tension caused by the problem. Outbursts of such joy appear to be characteristic of having solved a genuine problem. Polanyi makes reference to the famous utterance of Archimedes as an example. The historic scene of Archimedes rushing out of his bath into the streets of Seracuse shouting "Eureka" is looked upon as a joyful response in the face of having solved a real problem. (P.K., p. 122)

Evidently, Polanyi's view of problem solving assumes that nothing can be a problem or a solution in and of itself. A problem and its solution can be what they are only if they are a problem and a solution for someone. It is stated that "nothing is a problem or discovery in itself; it can be a problem only if it puzzles and worries somebody, and a discovery only if it relieves somebody from the burden of a problem." (P.K., p. 122) Problems and solutions therefore, are in the final analysis personal in nature. In view of this fact, it is understandable why Polanyi wants to investigate the process of discovery as the result of an intelligent effort rather than an outcome of random mechanical behavior. (P.K., pp. 120, 121)

To see a problem, claims Polanyi, "is a definite addition to knowledge." The hidden possibilities which it assumes to point to for its solution can be either true or false. But acknowledging that a problem can be solved and is worth solving is itself a discovery in its own right. Historically, a great number of discoveries have emerged as a mere side effect in the very struggle to solve problems that were taken to be worthy of pursuit.

In any case, to recognize a problem and seek its solution remains an intellectual effort adding to human knowledge. It involves the capability on the one hand to see a problem and on the other to reach out to hidden possibilities for solving it. The mark of a genius is linked to his capability of employing his intellectual powers far beyond the anticipatory powers of what is currently known. (P.K., p. 124) What he conceives to be a genuine problem wanting a solution reaches further than what is commonly taken at the moment as fixed and given. In a sense he is able to see problems that no one else can see. True discovery therefore, embodies an element of creativity and originality; an element that testifies to the heuristic intellectual passions of the discoverer.

## 2. The Logical Gap

Precisely because heuristic originality bears such an intrinsic relationship to discovery, the problem solving process entails an inevitable element of risk. In choosing a problem the investigator is taking a chance, for the problem might be either too difficult or insoluble. It might

appear that in such a case all the energies expended in attempting to solve the problem would be wasted. But Polanyi does not stop here. He proceeds to emphatically indicate that "to play safe may be equally wasteful." (P.K., p.124) For what a person is capable of achieving may never be realized. Especially when high intellectual gifts are at stake, the avoidance of risk results in a decisive loss of possible, fundamental discoveries. By arguing along these lines, Polanyi intends to show that no major discovery can occur without involving an element of risk. A certain personal judgement must necessarily be made assessing the investigator's own ability against the anticipated hardness of the problem to be pursued. The risk that characterizes such a judgement falls within the personal, day-to-day responsibility of all persons who seriously undertake independent scientific research. (P.K., p. 124)

In this context, Polanyi speaks of a "logical gap" that must be crossed during the process of solving a problem. The term "gap" intends to indicate that discovery cannot occur on the basis of strictly formalized procedures. (P.K., p. 123) A true discovery cannot be traced by a logically connected sequence of determinable steps. Originality is not only a sine qua non for its occurrence, but the true mark of an authentic discovery. It therefore remains an unspecifiable process. The logical gap mentioned here is nothing other than the one intellectual heuristic passions help overcome. And as mentioned earlier, originality is only possible through the power of such passions.

The width of the logical gap is directly proportionate to the ingenuity required to solve a certain problem. The harder the problem is the greater the gap. There is thus a direct relationship between the width of the gap and the intensity of the risk taken to cross the gap. In this relationship, the solution to the problem will appear to the investigator only as the risk is taken through his intellectual passions and the logical gap crossed.

'Illumination' is then the leap by which the logical gap is crossed. It is the plunge by which we gain a foothold at another shore of reality. On such plunges the scientist has to stake bit by bit his entire professional life. (P.K., p. 123)

### 3. Tacit Knowing and the Logical Gap

It should not be surprising that certain aspects of discovery such as unspecifiability, originality and personal risk allude to the presence of tacit knowing in the process of problem solving. Indeed, the structure of tacit knowing lies at the core of discovery. In the absence of the tacit

dimension discovery becomes an impossibility, for it is the ground and condition for its procedures and occurrence. To this matter we shall now turn our attention.

In an introduction written in 1963, prefacing one of his earlier works, Polanyi tries to identify the perennial problem involved in attempting to explain how discovery comes about. He refers to Plato as a man who had seen the real dilemma. He states,

The main difficulty has been pointed out by Plato in the Meno. He says that to reach 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 are not looking for anything and cannot expect to find anything. If science is the understanding of interesting shapes in nature, how does this understanding come about? How can we tell what things not yet understood are capable of being understood? (S.F.S., p. 14).

This problematic question sets the context out of which Polanyi pos s his own answer. He suggests that tacit knowing can provide the way out of this difficulty.

Initially the unknown aspect of the problem is approached by Polanyi as a focus, the center of which has for the moment no tangible character; a focus whose center "is necessarily empty." (K.B., p. 171) Such a focus is what an investigator strives to disclose. In spite of the intangible character of the focus, the discoverer strains his attention upon it in the hope that the focus will be rendered visible. But this procedure does not occur in isolation. Rather, it takes place in the context of a variety of evidence which the investigator has at his disposal at the time he recognizes a problem and attempts a solution. Moreover, all the evidence enters into the process of discovery in a particular manner. It does so only in the way of subsidiary clues pointing the way to a hidden reality awaiting disclosure. These clues aid discovery as subsidiary particulars alluding to a certain coherent configuration, the focus of which is the solution sought (S.F.S., pp. 23, 24; T.D., pp. 22, 23). The discoverer strains to focus onto the hidden solution as he considers his evidence; not focally, but as subsidiary parts. He attempts to think from the particulars to the focus in which the particulars are meaningfully co-ordinated. (P.K., pp. 127, 128) The relationship between the subsidiary particulars and the focus is an instrumental one. Clues are instruments for discovery. Features of problematic situations in which animals search for a solution are described by Polanyi as "tentative clues or instruments" for dispelling the problem. (P.K., p.120) And the same holds true in the case of human

discovery with regard to the evidence at hand.

Evidently, discovery follows a sequence that begins from known clues held subsidiarily and moves in the direction of the unknown focus. In this light, Polanyi talks of a movement from what is known to what is unknown. But in line with the structure of tacit knowing, the known is not to be attended focally. What is known as evidence is not to be explicitly scrutinized. Rather, what one should focally look at is the conclusion that follows from the known. It is thus the unknown that must be focused upon. In other words,

The admonition to look at the unknown really means that we should look at the known data, but not in themselves, rather as clues to the unknown; as pointers to it and parts of it. (P.K., p. 127)

At this juncture, the meaning of the logical gap receives greater clarity. From what has been said so far the logical gap appears to be consistently falling within the framework of tacit knowing. The gap which the investigator must cross in order to arrive at a discovery is that which exists between the clues and the solution, the known and the unknown, the subsidiary particulars and the focal center. The logical gap therefore, is nothing other than the unspecifiability which characterizes the subsidiary parts in their relationship to a to a co-ordinating focus. "A problem", claims Polanyi, "designates a gap within a constellation of clues pointing towards something unknown." (K.B., p. 171)

It now follows that the crossing of the logical gap becomes equivalent to the integration of subsidiary particulars into a focal center. And such an integration is only possible through an act of tacit knowing. Through the tacit act the unknown focus can be anticipated in terms of the available clues leading eventually to an integration, in which the focus becomes known. In an essay written in 1962 Polanyi presents the process in which the logical gap is bridged as a prime example of the phenomenal powers of tacit knowing. He states that

the capacity to know a problem is the most striking instance of our powers to integrate the meaning of a set of particulars by fixing our attention on a gap behind which we anticipate the presence of yet hidden knowledge. (K.B., p. 171)

Crossing the logical gap through the power of tacit knowing involves what Polanyi refers to as "foreknowledge". It is a knowledge that anticipates the hidden solution of

the problem at hand. Though no explicit knowledge of the solution is possessed, it can be foreshadowed on the basis of a foreknowledge which functions as a constituent of tacit knowing. Such a foreknowledge is but one of the components of the tacit structure. It can be identified with the investigator's evidence, clues or instrumental particulars, in terms of which the unknown focus is sought. As such, foreknowledge is always subsidiary knowledge anticipating focal knowledge behind the logical gap. In this framework Polanyi talks of "a tacit foreknowledge of yet undiscovered things". (T.D., pp. 23, 75)

Discovery therefore, must presuppose a sufficient foreknowledge if it is to succeed. For such a foreknowledge provides the basis upon which a problem can be seen and pursued. It guides each step along the way as it intuits with increasing proximity the solution to the problem. At each stage in the process of discovery it detects and chooses increasingly probable answers which tend to reduce the gap between the problem and its solution. In his early work Science Faith and Society (1946) Polanyi explains this procedure as follows:

In order to guess a series of such steps, an intimation of approaching nearer towards a solution must be received at every step. There must be a sufficient foreknowledge of the whole solution to guide conjecture with reasonable probability in making the right choice at each consecutive stage. (S.F.S., p.32)

This is what Polanyi means by "groping for the meaning of the facts". (P.K., pp. 150, 63) It is a groping in which the given particulars of the case are subsidiarily re-adjusted and reorganized, until they focus onto the hidden center behind the logical gap, thereby rendering it.

#### 4. Commitment in Discovery

Hence, from the very start, an inquiry into a problem assumes, and indeed must assume, that what it seeks to cover is genuinely real and not a fiction. Without such an assumption an authentic act of discovery can neither begin nor seriously be undertaken. The investigator therefore, must be convinced that there is something there to be discovered. Polanyi calls this something the "hidden reality" that awaits disclosure. And it is imperative that the potential discoverer believes in the existence of such reality. Although the solution to a problem is unknown, it is believed to exist, and such a belief is rooted in the investigator's conviction of how his available clues are subsidiarily co-ordinated into a focus. The integration of numerous particulars into a focus however, is only possible through an act of tacit knowing. By such an

act therefore, the investigator believes in the actual possibilities for a solution. In an act of tacit knowing the discoverer commits himself to certain expectations urging him to passionately launch himself into the enterprise of solving his problem. He thereby submits himself to what he expects to uncover; to the as of yet hidden reality. The effort of coming to know this reality is thus accompanied by a sense of obligation towards what the investigator acknowledges as the truth. (P.K., pp. 63, 117)

Here, we encounter once again that peculiar characteristic of tacit knowing which we have encountered in both the active principle on the more primitive levels of knowing and the intellectual passions on higher levels of development. The investigator's tacit commitment, by which he anticipates from accepted subsidiary particulars a hidden focus, is from the outset endorsed as a true conviction. Otherwise it would never lead to an actual engagement in problem solving activities. But it is crucial to note that such a commitment does not only comprehend the available subsidiary clues but also the hidden focus in which the clues cohere. For the faith of the discoverer hinges precisely around the manner in which the particulars are taken to cohere into a focus. "In a heuristic commitment", explains Polanyi, "affirmation, surrender, and legislation are fused into a single thought, bearing on a hidden reality." (P.K., pp. 310, 311) This is in accordance with the structure of tacit knowing.

In such a framework, the hidden focus acquires a certain status, in which it becomes related to the subsidiary parts according to the belief held by the investigator. So now, there is on the one hand the self accredited nature of commitment and on the other hand the unknown focus as a component comprehended by such a commitment. This relationship leads to the following significant consequence. It demands that the solutions to problems sought by the investigator are arrived at in a context of being taken as true. Their emergence as discoveries occurs in the light of self accredited belief, which endorses the discovered solutions as true. Solutions therefore, arise accredited in advance by virtue of the comprehensive framework of belief in which they are placed from the very beginning. Hence in the context of belief one arrives at a solution as a fulfilment of his anticipated expectations. And this holds true in the case of each discoverer irrespective of whether or not his discovery is a true one. Recapitulating then, in Polanyi's words,

Only if we believe that this solution exists can we passionately search for it and evoke from ourselves heuristic steps towards its discovery. Therefore, as it emerges in response to our search for something we believe to be there, discovery, or supposed discovery, will

always come to us with the conviction of its being true. It arrives accredited in advance by the heuristic craving which evoked it. (P.K., p.130)

But this is not all. For the actual arrival at a solution plays its own role in the process of discovery. In reaching a solution out of the context of certain beliefs, the beliefs themselves are confirmed. There is a correlativity here between beliefs and solution which results in a complementary relationship. They mutually reinforce one another. The reason why the solution is accepted is due to the claim of the beliefs out of which it arises to reveal reality. And in turn, the solution, having been accepted as true, confirms the framework of beliefs which conceived it. In the final analysis the relationship between these various components can only be sustained through the powers of personal acts of tacit commitment in which the knower personally accredits his own vision of reality. In his analysis of mathematical discovery Polanyi describes the above phenomenon as follows:

Mathematical heuristics, though aiming at conceptual reorganization without references to new experience, once more exemplifies in its own terms that an intellectual striving entails its conviction of anticipating reality. It illustrates also how this conviction finds itself confirmed by the eventual solution, which 'solves' precisely because it successfully claims to reveal an aspect of reality. And we can see once more also, how the whole process of discovery and confirmation ultimately relies on our own accrediting of our own vision of reality. (P.K., p. 130)

##### 5. Discovery, Commitment and Change

Finally it must be acknowledged that the confirmation of one's commitment by a new discovery is simultaneously accompanied by a degree of change in the commitment itself. In crossing the logical gap through the powers of tacit knowing, one's framework out of which discovery is initiated undergoes a necessary alteration. (P.K., pp. 143) pp.189. The heuristic process of framework modification, already discussed, demands that in assimilating new knowledge the subsidiary framework be so changed that it allows for novelties to be seen, while integrated into the framework. Consequently commitment as the actual integrator between framework and novelty becomes modified as well. For as we said earlier the nature of commitment is such that it ultimately determines the relationship between subsidiary particulars and their focal center, by comprehending both components within its own structure.

When discovery is observed in the light of ongoing modification, one can understand why Polanyi does not want to ascribe strict finality to discovery. He claims that no discovery can impose an end to the investigator's strivings in trying to achieve closer contact with reality. By this however, it is not meant that actual discovery never reaches consummation. What it does mean is that the investigator's sense of "approaching nearer to reality is not exhausted by the consummation of discovery". (K.B., p. 172) Rather, it persists in his belief that his discovery discloses something real, and since it is real it will be expected to reappear in the future in various unspecified and unpredictable ways. (P.K., p.124) A discovery carries with it implications, which, as such, are never explicitly known at the time it is made. These implications remain to be seen. Nevertheless, a discovery along with its formally unspecified consequences is held to be true. Even though the discoverer knows that his findings might be proven wrong in the future, he holds to his present discovery with universal intent. He accepts it as universally valid. To the extent therefore, that a discovery is accredited with universal import, its unseen consequences readily receive acceptance as well. In fact they are anticipated to further reinforce the commitment through which they are held. And such a conviction of course can only be sustained within the context of tacit commitment, while it too remains open to future modifications by the unspecified implications presently endorsed in the discovery.

Here we see how Polanyi attempts to ascribe universal validity to the content of tacit commitment, while at the same time adhering to an ever-changing and continuously modified commitment. No doubt, the paradox of self set, universally valid standards, which Polanyi himself clearly recognizes, once again comes to the fore. It is also evident how Polanyi's geneticistic view of the world operates here as an underlying factor. In this perspective the constant re-adaptation of self accredited commitment testifies also to the heuristic character of discovery, the prime work of which is originality. Evidently, themes such as the universal intent of commitment, the originality of discovery and evolutionism betray an inseparable interpenetrating relationship, such that it compels Polanyi to say,

whenever we make (or believe we have made) contact with reality, we anticipate an indeterminate range of unexpected future confirmations of our knowledge derived from this contact. The interpretative framework of the educated mind is ever ready to meet somewhat novel experiences, and to deal with them in a somewhat novel manner. In this sense all life is endowed with originality and originality

of a higher order is but a magnified form of a universal biological adaptivity. (P.K., p. 124)

## 6. Truth

As unique occurrences therefore, discoveries take place in the context of a self endorsed universally valid commitment, which, itself is subject to continuous re-adaptation. For this reason, a system of beliefs to which an investigator commits himself is true to the extent to which it has the capacity to meet the following two requirements. First, it must be able to anticipate new and novel information. The second requirement demands that the subsidiary knowledge at hand be flexible enough to ensure the subsidiary instrumental manipulations necessary for actually focusing on and thereby assimilating new knowledge. It should be noted here that these requirements correspond to the two aspects of the relationship between the two terms of tacit knowing, namely, its "functional" and "phenomenal" structure. (T.D., pp. 10, 11)

Hence, the truth of a framework appears to be founded upon its capacity for anticipatory adaptability. We can now begin to come to grips with Polanyi's definition of truth. According to Polanyi, the truth of a framework to which one commits himself is appraised in terms of "the intimations of its fruitfulness". Man's preoccupation with truth is not concerned with a present possession of definitive knowledge. The claim for the truth lies primarily in the intimation of unspecifiable consequences. It pertains to the anticipatory powers of a framework. One rests on the truth of his present commitment as he acknowledges its leading to further valid consequences. The truth of a framework is therefore approached from the vantage point of what it can lead to; what can emerge out of it.

In this light Polanyi talks of the truth of the Copernican system in terms of the various scientific discoveries that it led to. The truth of Copernicanism was nothing that the system possessed in and of itself. Copernicanism was true only in the sense that "it was a fruitful source of truth" (P.K., p. 147) For Polanyi this formulation does not intend to reduce the Copernican system to the status of mere usefulness. Rather, it attempts to establish its truth precisely because it led to the discoveries of Kepler and Newton.

This anticipatory power of one's framework is akin to what we met in the process of discovery. (P.K., p. 128) Just as the known, subsidiary clues allude to a hidden reality, so also an entire framework intimates the emergence

of new discoveries, which are as of yet unspecifiable. It is an intimation of a prospective contact with reality. (P.K., p. 106) By such intimations one assures himself that something not yet explicitly seen is really there. And in so doing he endorses the truth of his own framework.

Evidently, the unspecifiable intimations of consequences arise out of the self accredited conviction, by which a person commits himself to the potentiality of his framework. The adaptable relationship between a subsidiary functioning framework and an anticipated focus is thus rooted in the prior commitment which endorses the validity of such a relationship. That is why a person can retain his sanity while modifying his own framework in attempting to bring to focus a new reality. His world does not fall apart, but is sustained through an act of tacit commitment. In his analysis of language Polanyi calls this process of modification "a tacit, irreversible, heuristic feat". (P.K., p. 106) Through such an act, one proceeds in the hope of attuning himself more closely to what is true. There is thus a striving that continuously attempts to increase one's grip of what he acknowledges to be true. (P.K., p. 112)

It is further suggested by Polanyi that one's subsidiary framework, in terms of which he anticipates and assimilates new knowledge, is never believed to be entirely wrong. It is held in the belief that in certain respects it touches reality, and to this extent the framework is judged to be reliable. When a person proceeds to modify his own position, he assumes to be doing so on the basis of the true conceptions present in his interpretive framework. Hence a modification occurs always in view of what a person commits himself to be true. In this light, one can speak of a self modified process in which a position renders itself increasingly true, as it constantly modifies itself in terms of its own resources. This exhibits a movement, as it were, from a 'true' to a truer' framework. Out of such a perspective Polanyi states that

Man's whole intellectual life would be thrown away should this interpretive framework be wholly false; he is rational only to the extent to which the conceptions to which he is committed are true. The use of the word 'true' in the preceding sentence is part of the process of re-defining the meaning of truth, so as to make it truer in its own modified sense. (P.K., p. 112)

So we see that what a person is committed to as being true can alter itself only on its own grounds. One can be increasingly approaching the truth only out of what has been

presently taken to be the truth. And it is in the context of such a commitment to the truth that subsidiarily held particulars are integrated into anticipated focal centers. Truth therefore, becomes rooted in a self accredited commitment, in which subsidiary particulars and intimated foci are held together in a particular relationship, while allowed indefinite modification in pursuing a closer contact with reality.

Consequently, establishing and holding of truth is never an impersonal affair, but it is, rather, inherently dependent on a self accredited personal act. (P.K., p. 71) Truth is personal. Finally, the competence of one's commitment, by which truth is personally held and pursued with universal intent, renders truth both exclusive and singular. "Therefore", claims Polanyi, "though every person may believe something different to be true, there is only one truth." (P.K., p. 315)

#### E. Science: Facts, Evidence and Theories

##### 1. General remarks

In our analysis of scientific discovery we saw how the gap between a problem and its solution is bridged by a self accredited personal commitment, through which subsidiarily known givens are integrated into a focal center. Furthermore, we noted that truth remains at all times a function of personal commitment in that the discovery and endorsement of knowledge taken to be true depend on an antecedent personal judgement. With this general orientation in mind we can now look at the different constituents of science in greater detail. We shall begin this analysis by first examining the phenomenon of factuality and evidence in science.

From the very early stages of his work in the philosophy of science, Polanyi is determined to oppose the popular notion that a scientist collects his facts in a thorough-going, unprejudiced and neutral fashion. (S.F.S., p.28) This view, he declares, is quite false, for no meaningful discovery ever occurs in this way. On the contrary, the move from the known to the unknown in the process of discovery requires that certain facts be accepted from the outset as being both true and relevant. The scientist must adhere to them believing that they are capable of orienting him to his anticipated discovery. At this point we should recall Polanyi's analysis of intellectual passions, and in particular their selective function. As we said earlier, this aspect of intellectual passions indicates to the scientist which facts are intellectually precious, and more particularly which facts are precious to science. Its function is to "distinguish between demonstrable facts which are of scientific interest, and those which are not." (P.K., p. 135)

In trying to analyze the premises of a skillful achievement, for example, one must first acknowledge and identify authentic instances of such an achievement. This holds true whether one is analyzing music, law or even science itself. Polanyi further adds that in deciding the controversial question which are indeed authentic instances intended for analysis, one is compelled to take a stance. If we desire to investigate scientific acts, for instance, we must, he says,

reflect on facts and parts of science which we acknowledge as valid, or at least on facts and parts of science which we regard as competently alleged, even if not validly established. (P.K., p. 163)

In this light, Polanyi interprets all the results of past discoveries. He would acknowledge, he claims, that according to the facts known to Kepler the number of planets was six, even though this is false according to today's knowledge. The discoveries of the past might have been incompetent, speculative and false, but what Polanyi suggests is that they were all arrived at on the basis of certain accepted facts taken to be known and reliable.

## 2. Universals

With these preliminary remarks regarding the nature of factuality and evidence in science we can now proceed to examine in greater specificity certain key issues pertinent to scientific activity. These will include the formation of universals, the relation between theory and fact, the nature of probability statements, the relation between order and randomness and finally the limited role of evidence in establishing theories. We shall now begin with the process of arriving at universals.

The most explicit statement on this problem can be found in an article written in 1962 entitled "Tacit Knowing: Its Bearing on Some Problems of Philosophy". In this article, Polanyi approaches the matter by expositing the main historical dilemmas that have surrounded the problem of universals. In his view, Plato was the first man who introduced the difficulty. "Plato", explains Polanyi,

was the first to be troubled by the fact that in applying our conception of a class of things, we keep identifying objects that are different from each other in every particular. If every man is clearly distinguishable from another and we yet recognize each of them as a man, what kind of man is this, as which all these men are recognized? (K.B., p. 165)

Plato's conclusion was that the idea of man in general refers to a perfect man who possess no individual properties and of which all individual men are imperfect copies.

Polanyi however, objects to this view by raising the difficulty of how a featureless concept of man in general can have such perfect attributes. This question, claims Polanyi, has perplexed philosophers since antiquity. Objections are also raised against a nominalistic interpretation of universals. For how can one justify, asks Polanyi, the labelling of a collection of entirely different individuals by the same name? And further, how can one expect to subsume under such a name future instances of men who differ in every particular from each other? To try and resolve these problems by attempting to specify the characteristics of man is equally problematic, for in doing so other names will be used to identify instances of different features. (K.B., p. 166)

In his own approach Polanyi departs from both the platonic and nominalist interpretation of universals. His explanation begins with a comparison between the process of forming universals and that of visual perception. The two processes are presented as being structurally identical. In perception, explains Polanyi, one sees and recognizes objects according to their nature, however different each past experience has been in which the same object was perceived. The thousand particular instances in which a viewer perceived an object culminate into a comprehensive awareness of their joint meaning; a process common to all perception. According to Polanyi, such awareness is achieved when

we rely on our awareness of great many  
clues to which we are not attending at  
the time, for seeing things in a particular  
way which is the meaning of these clues  
comprehended by us. (K.B., p. 166)

Apparently, it is suggested that the identification of objects according to classes in which they belong takes place already on the level of perception. Particular things can be identified even without naming them through terms. Though animals have no language, they can still identify members of a class.

However, even when classes of particulars are linguistically designated and universal concepts formed, the process of arriving at classes remains essentially the same. Just as in the case of perception, the formation of universals entails the comprehensive integration of numerous individual instances into a common meaning. This occurs while all the particulars are relied upon merely as clues to the universal

concept in which they cohere. (K.B., pp. 166, 167) In this sense the process of arriving at universals is seen as one of "empirical induction" while universals themselves are defined as "the joint meaning of things forming a class." (K.B., pp. 166, 170)

Once again the structure of tacit knowing emerges as the ordering principle for explaining the entire process of forming universals. Polanyi himself states that

I am interpreting the formation of class concepts (along with the discovery of natural laws) as based ultimately on a process of tacit knowing, the operations of which I have exemplified in learning of skills, the recognition of physiognomies, the mastery of tests, the use of tools, the uttering of speech, and the act of visual perception. The powers of integration which achieve these acts have the same structure throughout. (K.B., p. 167)

Moreover, all the above achievements including the formation of universals are presented as "variants of the same organismic process." Such a statement, as we shall see in our subsequent analysis, betrays a close tie between organic processes and tacit knowing.

However, the most fundamental aspect of Polanyi's explanation of universals lies in his attempt to show that the transition from particular clues to universal concepts is not a process of explicit inference. This is Polanyi's real burden. If we recall the original structure of tacit knowing, we are reminded of the fact that the relationship between subsidiary particulars and their focal meaning is essentially unspecifiable. A tacit act of integration is a heuristic one, and as such it cannot be explicitly retraced without altering the meaning of the particulars with respect to their focal coherence. Insofar as the discovery of universals advances in accordance with the principle of tacit knowing, one would expect now that the element of unspecifiability would surface also in forming universals. As one should suspect by now, the unspecifiable component enters the picture at the point where the subsidiary clues are joined together into the concept of a class. The relationship between clues and universals embodies a chasm which tacit knowing alone can bridge. It is the logical gap which we found operative in all scientific discovery, the crossing of which is achieved only by one's tacit powers of integration. (K. B., p. 171)

For this reason universals cannot be arrived at in terms

of explicit inference, nor are there strict rules for deriving general laws from individual instances. In fact, Polanyi claims, the difficulties that have arisen over the problem of universals are the result of "seeking an explicit procedure for forming collections of objects which can be justifiably designated by the same universal term." (K.B., p. 166)

The principle of unspecifiability is further accentuated when particular instances of a class are considered in themselves. By regarding one instance at a time one discovers that all the objects differ from each other in every particular way. Hence the explicit justification as to why they should be classified under the same universal becomes exceedingly problematic. Polanyi himself then raises the following question in response to which he asserts a resolution to the dilemma.

Is there any evidence that tacit knowing can establish a uniform meaning for clues, which, regarded in themselves, have nothing that is the same in them? The answer is that tacit knowing can in fact integrate conflicting clues in various ways. (K.B., p. 167)

The latter statement must not be understood to mean that contradictory clues are ascribed an arbitrary uniformity. Rather, Polanyi bases such a formulation on the assumption that the joint meaning of subsidiary clues transcends the meaning of each particular taken by itself. To illustrate this he points to analogous phenomena on various other levels of knowing. In perception for instance he talks of how "conflicting visual clues are integrated to a true sight". He explains for example, how the different pictures that an object casts on the retina of each eye are integrated into a coherent image. The discrepancy between the difference of the two pictures is resolved as perception reveals "a joint meaning of conflicting clues in terms of a new quality". (K.B., p. 168) This new quality is also present in the formation of universals through tacit integration.

In addition Polanyi notes that a universal concept exhibits an "unsubstantial character". As the focus in terms of which we are subsidiarily aware of particular members of a class it "appears vague and almost empty". (K.B., p. 168)

From our investigation of Polanyi's analysis of the problem of universals it has become evident how in this case as well the principle of tacit knowing plays the most decisive role. But as we have seen earlier, an act of tacit knowing implies a tacit assent to the manner in which a certain number of particulars cohere in a focal center. And

such an assent indispensably involves the personal participation of the knower. In the case of universals, he must commit himself to the belief that a set of individual instances do in fact point jointly to a universal concept. Such is the person's reliance upon particulars as clues to a joint meaning. Moreover, the discovery of universals through tacit activity is performed with universal intent. Within the context of tacit assent, general concepts are held to be universally valid. As they are considered to be a genuine token of reality rather than fictitious, universals are held with certain expectations. First, there is the anticipation of future individual instances capable of being subsumed under the discovered universals. And secondly, there is the expectation that a universal, insofar as it is real, will manifest an indefinite range of properties not yet seen. (K.B., pp. 170, 171)

### 3. Theory and Fact: The Problem of Correspondence

If we take Polanyi's analysis of universals seriously we might have a handle on the principle that determines the manner in which he conceives of the relationship between theories and facts, hypothesis and evidence, probability and actuality, even order and randomness. In particular, the element of unspecifiability can serve as the most important clue in understanding Polanyi's formulations on such matters, to which we must now turn.

The controversial and historically crucial problem of correspondence between theories and facts appears to be in the foreground of Polanyi's attention. In his Personal Knowledge the problem of correspondence becomes the subject of detailed scrutiny from the very first chapter. The most fundamental question raised in this context is whether, or to what extent can one speak of a strict identity between theory and fact. Polanyi claims that ever since their historical emergence,

The avowed purpose of the exact sciences is to establish complete intellectual control over experience in terms of precise rules which can be formally set out and empirically tested. (P.K., p. 18)

The ultimate goal of this ideal, he continues, is to ascribe all truth and all error to an exact theory of the universe, while preventing all interventions of personal judgement. One simply follows the rules of the theory. If any, states Polanyi, the theory of classical mechanics exhibits the closest approximation to this goal, to the point where it was often thought that it had actually achieved it. This view however, is for Polanyi a problematic one, as it leaves out of account the judgements made regarding the application of the formulae of mechanics to facts of experience.

The computation of the position of celestial bodies by the use of a newtonian formula is referred to as illustrative of the fact that the relation between data and a formula is not as objective as the adherers to the above ideal had thought. To begin with, Polanyi explains, the collected measurements of planetary positions, which are inserted as values in the formula, are not directly facts of experience. Rather, they are facts from certain instrument readings. On the basis of these readings, one not only derives the facts for his computations, but also checks the results of his computations. This indicates that the introduction of computed measurements into an exact formula is never "fully automatic". For according to Polanyi,

any correlation between a measured number introduced into an exact theory and the corresponding instrument readings, rests on an estimate of observational errors which cannot be definitively prescribed by rule. (P.K., p. 19).

In the light of these considerations, the conclusion is reached that the scientist can only proceed from the probable value of his initial computations to the probable outcome of the formula in which they are inserted. The relationship between initial data and the resultant value is never one of strict correlation, and to this extent the scientific procedure retains an element of indeterminacy.

Another example that Polanyi points to comes from the field of chemistry. It deals with the law of chemical proportions through which the atomic weight of each element can be calculated, as the ratio of parts in a chemical compound are represented by a simple proportion of integers. For example, the methylene dichloride compound  $\text{CH}_2\text{Cl}_2$  can be represented by the ratio 1:2:2 i.e., one part of carbon, to two parts of hydrogen to two parts of chlorine. But in an actual experiment where actual proportions are recorded through instrument readings, the ratios never come out as simple integers. In fact, for each measurement there is a range of instrument readings none of which exhibit a strict correspondence to the simple ratios of the chemical formula. However, if the measured proportion of carbon to hydrogen in the compound  $\text{CH}_2\text{Cl}_2$  comes out 0.504, one will allow for 0.004 as probable error<sup>2</sup> thus representing the ratio between carbon and hydrogen as 1:2. But the decision to level such variances in the data of an experiment to fit the law of chemical proportions rests on an accepted assumption; namely, that the ratio between elements be a simple one, made up of small integers (P.K., p. 41). Such a decision relies on an act of personal appraisal.

Polanyi's main concern in both examples is to show that even in the most exact sciences the personal judgement of the scientist is involved. (P.K., p. 20) And this conclusion rests on the fundamental premise that the relationship between theory and data cannot be definitively estimated by prescribed rules (P.K., pp. 19, 41). The relationship remains essentially indeterminate, and at this juncture the scientist must take a stand. Formalization therefore can only be achieved within certain limits.

#### 4. Probability

Related to the problem of theory and fact is also that of probability. Polanyi asserts that the predictions made on the basis of probability can never be strictly correlated to actual occurrences. The reason for this is the fact that predictions of probability cannot specify as to whether or not the anticipated event will actually take place. In fact they leave open the possibility that it might not. Polanyi illustrates this by an example from quantum mechanics, where the position of a hydrogen atom from its nucleus at any given time is pre-determined within a certain range of probability. But precisely because the prediction is based on probability the atom may or may not be found at the designated position on a specific occasion (P.K., p. 21). However, Polanyi does not intend here to imply that probability statements are meaningless. Rather, their significance lies in the fact that they provide certain restrictions within which certain expectations can be held. Although their restrictions are never strictly objective, they grant a degree of orientation to the person who accepts them. As such they provide guidance to the personal participation of the knower in the events, to which probability statements refer (P.K., p. 21).

Consequently, the acknowledgement of probability is looked upon as a personal appraisal. Polanyi further notes the important fact that not all probabilities are accepted as true, for some are rejected as too improbable (P.K., p. 24). The scientist himself must make an assessment as to what is truly probable concerning certain events, and to this extent it entails his personal commitment (T.D., p. 77).

#### 5. Irreducibility

It should be quite evident by now how Polanyi's analyses rest on the assumption that neither theory nor probability can be strictly correlated to actual occurrences. In the final analysis theory and fact, as well as probability and actuality display a mutually irreducible character. From this perspective Polanyi asserts that "Probability statements can never be strictly contradicted by experience" (P.K., p. 21). The same also holds true for theory. By these statements however, Polanyi does not mean that theory or probability is entirely divorced from experience. In his analysis of geometrical classifications

of crystals he states that although a geometrical theory of crystals says nothing definite about experience, it is nevertheless inspired from experience. The construction of such theories, he claims, tend to

disclose those hidden principles of the experienced world of which some scattered traces had first stimulated the imaginative process by which these constructions were conceived (P.K., p. 46).

Hence, although a theory never strictly defines experience it bears potentially on experience.

These arguments bring us to another important aspect of Polanyi's philosophy of science. For if theory and experience are ultimately irreducible correlates, it follows that experience can never strictly refute a theory (P.K., p. 47). A theory explains Polanyi is valued in terms of its own consistency, according to its own axioms. "Its acceptance rests primarily on our validation of its consistency, ingenuity and profundity" (P.K., p. 46). And this is a matter of our personal appreciation of order, to which we give assent with universal intent. Polanyi states that

The application of crystallographic theory to experience is open to the hazards of empirical refutation only in the same sense as a marching song played by the band at the head of a marching column. If it is not found apposite it will not be popular (P.K., p. 47).

In this sense, he continues, a theory can be said to "transcend the experience to which it applies." It should be noted here that the transcendence of theory over experience bears a close resemblance to the manner in which universals have been found to transcend the subsidiary clues they comprehend. Further, this characterizes all forms of idealization. He explains that a theory of ideal gases for example cannot be refuted by observed deviations from it. We accept such an ideal order only to the extent that "we believe in our capacity for appreciating a kind of fundamental orderliness in nature which underlies some of its less orderly appearances" (P.K., p. 48).

So we see that the acceptance of a theory must ultimately depend on the personal commitment of the one who accepts it. From his very early works Polanyi pointed out that there can be no explicit rules to strictly determine the connection between scientific propositions and observed data (S.F.S., p. 29). The scientist must at some point

commit himself to his theory, particularly in view of the restrictions of time. He cannot proceed unbiased by testing millions of hypotheses hoping that he will arrive at the true one solely on the basis of verification. Rather he must, and does select those hypotheses which he accepts as having a "high chance of being true" (P.K., p. 30).

## 6. Order and Randomness

The unspecifiable correlation of universals and individual occurrences, theories and facts, probabilities and actualities, all of which are rooted in the antecedent principle of tacit commitment provide the general pattern in light of which Polanyi discusses the relationship between order and randomness. It should be stated from the outset that while the latter is dependent on the structure of the above mentioned correlations, it is neither identical nor parallel to them. In other words the relation between universals and individual occurrences, for example, is not parallel to that between order and randomness. The precise connection between the former and the latter should become evident in what immediately follows.

It is said that science helps one to decide whether or not certain events occur accidentally. But, Polanyi argues, the assessment that something has occurred by chance can be made "only with a view to the alternative possibility of its being governed by a particular pattern of orderliness" (P.K., p. 33). Hence, a decision as to whether certain events are governed by order, or by chance depends on "two different but mutually correlated appraisals," namely, that of order and randomness. Order therefore, implies chance and chance implies order.

Polanyi tries to illustrate this phenomenon by referring to visual perception. He suggests that the visual identification of an object as an ordered entity depends on the contrast between it and its surroundings. The object will render itself clear to the extent to which its background is accidental, i.e., random. The order that characterizes the coherence of the object must not comprehend any elements from the surroundings. It is emphasized that "no feature of the background may be linked in an orderly manner to the figure" (P.K., p. 38).

The same relationships are noted also in the case of a system where a process of a planetary motion is determined by an ordering principle. The objects within the system are said to be linked to one another in an orderly manner, insofar as the system's relation to the objects outside of it is purely random.

In view of the correlative relationship between order and randomness, it can also be said that the clarity in which both the visual object and the determined system will appear depends on the intensity by which their internal particulars cohere in a regular pattern. Hence, Polanyi states,

Any entity - whether an object or determined process - will be more clearly set off against its background, the more amply its internal particulars show steadiness and regularity - combined with an amply confirmed absence of any co-variance between these particulars and those of the background (P.K., p. 38).

From such an analysis certain conclusions can now be drawn, which will not only foreshadow what is to follow, but which will appear also consistent with Polanyi's general systematic approach. We have seen that theories, hypotheses, as well as probabilities can never be strictly proven or disproven by experience. In view of our analysis of order and randomness we can now further add that only certain events or facts belong to a certain order. Those entities which fall outside of an order will appear contrary to that order, and hence random. Particulars that are subsumed under one kind of order might relate at random with respect to another kind of order. These relationships are of crucial significance for Polanyi's theory, particularly, as we shall soon see, in his views on the scope and limitations of evidence.

## 7. Evidence

As we proceed to expound upon the nature of evidence, we should keep in mind not only the unspecifiable character of the correlations between universals and individual occurrences, theories and facts and probabilities and actualities, but also the mutually exclusive and interdependent functions of order and randomness.

The function and role that evidence plays in justifying a theory is compared to the process of visual perception. Polanyi explains how in perception the eye will often see certain details which fit the whole picture that one is looking at, although in reality they are not actually there. On other occasions the eye will tend to overlook certain details, and these are the elements that make no sense in relation to the viewed object.

Likewise in science, facts which appear to cohere with a theory, even with slight accuracy, are taken to be of scientific value, while those that do not are not even considered (P.K., p. 138). The most stubborn facts, even if they cannot be refuted for the moment, will be set aside if there is no place for them within a scientific generalization. Such a phenomenon is not viewed as an unfortunate dilemma, but rather as the natural way science proceeds. Ignoring certain facts is not an arbitrary decision on the part of the scientist, for it always takes place within a context of anticipating the falsity of such facts, even though at present it cannot be demonstrated. Polanyi claims that

It is the normal practice of scientists to ignore evidence which appears incompatible with the accepted system of scientific knowledge, in the hope that it will eventually prove false or irrelevant (P.K., p. 138).

This indicates that experienced facts do not have the final word as to whether a theory is true or not. Hence, in addition to the fact that there is no strict correlation between theory and facts, we discover further that with respect to a theory, only certain facts are relevant. Polanyi, here, has added an additional restriction to the role that evidence can play. "Facts," he explains,

which are not described by the theory create no difficulty for the theory, for it regards them as irrelevant to itself. Such a theory functions as a comprehensive idiom which consolidates that experience to which it is apposite and leaves unheeded whatever is not comprehended by it (P.K., p. 47).

Thus, discrepancies between theory and facts are automatically waved by excluding those facts which cause the inconvenience. In science, such phenomena are referred to as "anomalies" (P.K., p. 20). An example of this is found in Polanyi's analysis of crystallography, where he indicates that when a crystal specimen deviates from the theory, the fault is attributed to the crystal rather than the theory (P.K., p. 44).

Once again our investigation leads us to the most fundamental conception upon which Polanyi's entire philosophy of science rests. We are now confronted with the reality that ultimately the relation between theories and facts is rooted in a personal appraisal involving the commitment of the knower. Even generalizations such as 'all men must die', held by some with utmost assurance on the

basis of experiential evidence, claims Polanyi, are commonly denied by others. Beliefs of primitive people can serve as an example of such a denial. The firmness by which one holds to what he accepts to be true "only shows that we are inclined to regard our own particular convictions as inescapable" (S.F.S., p. 25).

Finally we must note that all orderly patterns are acknowledged by man himself, and as such, the appraisal of order is an act of personal knowledge (P.K., pp. 36, 37). And "the appraisal of such order is made with universal intent and conveys indeed a claim to an unlimited range of as yet unspecifiable true intimations" (P.K., p. 37).

## F. SCIENCE AND ITS PREMISES

### 1. Pre-scientific Knowledge

Having examined the internal process of scientific inquiry, we are now in a position to revisit the subject of scientific activity as a whole, with an eye to what now is implied in such processes. Such a pursuit, in Polanyi's opinion, centers on the premises of science; all the necessary prerequisites that make scientific inquiry possible.

Thus far we have seen how the acquisition of scientific knowledge through universal generalizations, probability statements and systems of order entails a process of discovery, in which a logical gap is crossed through the heuristic powers of personal commitment; a commitment through which the scientific discoveries are anticipatorily arrived at on the basis of relied-upon beliefs. The latter, as we saw, involves the acceptance of a selected pattern of facts as true and relevant for the solution of specific problems.

But now, Polanyi suggests, the selection and acceptance of such facts presupposes an antecedent interest in the subject matter of these facts. This interest, in Polanyi's view, is implied in the actual process of selecting facts out of everyday thought, as well as in the employment of these facts in scientific analysis. In science it emerges as an implicit guide orienting and directing the scientist to his object of investigation.

We may approach the phenomenon of antecedent interest through a brief exposition of Polanyi's view of order in the encyclopedia of the sciences. The order of the various sciences becomes immediately intelligible when the sciences are viewed from the vantage point of the intrinsic interest of the subject matter they study. The different sciences, according to Polanyi, display an ascending order, in which intrinsic interest becomes increasingly accentuated. In this order the intrinsic interest of each science stands

in competition with its accuracy and systematic relevance. Thus, in the order of the sciences a gradient appears, in which intrinsic interest on the one hand and accuracy and systematic relevance on the other relate in an inversely proportionate manner. In other words, the more interesting the subject matter of science, the less accuracy and systematic relevance it will have; and likewise a relatively uninteresting subject matter will be compensated by greater accuracy and systematic relevance. The study of living beings for instance, is more interesting than dead bodies; man and human concerns, such as his place in the universe, his origin and destiny is more interesting than the animal world. Yet, as the interest increases, accuracy and systematic precision decrease (P.K., p. 138). However, the crucial fact is that no science can approach a subject matter exclusively on the basis of any of the two variables. No matter how systematic and accurate a science can be, it never escapes an element of intrinsic interest, and the same holds true in the reverse direction. The approach therefore, of any science to its own field of investigation must occur within the context these two coordinating limits.<sup>13</sup>

From this schema certain consequences appear to follow, with regard to the ingredients that enter into the scientist's approach to his own field. Polanyi asserts that insofar as the interest of a science depends on the prior intrinsic interest of its subject matter, the scientist must assume a "pre-scientific" concern for the object he intends to investigate. The scientist must accept a pre-scientific conception of what is to be studied, which is not itself the result of scientific analysis. This formulation attempts to do justice to the variable of intrinsic interest in the different sciences, as the correlate of accuracy and systematic relevance. Polanyi states this position in the light of the fact that man's appreciation for the entities he studies precedes his scientific scrutiny of them. Attending things scientifically is in fact grounded in and continuous with the ordinary interest in which persons view different entities. Such an interest is the result of pre-scientific ordinary human experience, which recognizes the existence of things prior to their subjection to analysis. In rather forceful words Polanyi puts the matter as follows:

In relying for its own interest on the antecedent interest of its subject matter, science must accept to an important extent the pre-scientific conception of these subject matters. The existence of animals was not discovered by zoologists, nor or plants by botanists, and the scientific value of zoology and

botany is but an extension of man's pre-scientific interest in animals and plants (P.K., p. 139).

Polanyi here, implies a pre-scientific knowledge of what science analyzes, without which science cannot operate. Before a scientist can devise tests for intelligence for example, he must know what it is that he is trying to test. "Experimental studies," claims Polanyi,

made on animals and plants remain meaningless, except through their bearing on animals and plants as known to us by ordinary experience and through Natural history (P.K., p. 354).

In an essay written in 1962 Polanyi explains the phenomenon of pre-scientific knowledge in terms of a topography of a frog. It is stated that no human mind can comprehend that in fact a frog is being studied, by merely surveying an atomic topography of a frog. And this holds equally true for its chemical and physical topography (K.B., p. 178). Another example in the same essay comes from mathematics. If a set of mathematical formulas were to answer questions concerning certain experiences, those experiences must be pre-scientifically known in some way, or else one would not know what it is that such formulas are supposed to explain. In the first instance, the object to be explained must be other than the formulas which are to explain it. Secondly, the formulas are meaningful only if they have a bearing on the object to be explained. But assessing as to whether or not the formulas have such a bearing assumes that there is sufficient pre-understanding of the object to which they are applied. Otherwise, the judgement as to whether the formulas have in fact explained the object cannot be made (K.B., p. 179).

We now arrive at the question concerning the relationship between pre-scientific and scientific knowledge or, to put it differently, between intrinsic interest on the one hand and accuracy and systematic relevance on the other. A sensitive reading of Polanyi's work on this issue will disclose a striking parallel between pre-scientific and scientific knowledge on the one hand, and the two complementary principles of tacit knowing on the other. It appears that pre-scientific interest and systematic scientific concerns relate to one another as subsidiary elements relate to a focal center, while integrated together in an act of tacit knowing. The two terms are held together as two kinds of awareness both of which are comprehended by tacit action. Moreover, scientific accuracy and systematic relevance is immediately rendered meaningless if it is cut off from its pre-scientific base. Meaningful scientific

scrutiny necessarily requires that it be tacitly integrated with a pre-scientific, subsidiary interest (K.B., pp. 150, 151, 178). The atomic topography of the frog as well as the application of mathematical formulas assume a subsidiary awareness of the reality to which they are relevant, and in which they must be tacitly integrated, if the scientific results are to make any sense.

But the picture becomes even more complex. For Polanyi indicates that pre-scientific knowledge is not only tacitly bound up with science, but that it itself comprehends an informal tacit integration of the cohering parts of the entity which science may study (K.B., p. 151; T.D., p. 20). Hence, while pre-scientific awareness is a subsidiary component of explicit, scientific formalizations, it, on its own level, informally integrates subsidiary particulars into focal wholes. It is thus observed that while the formal focusing of science is tacitly integrated with a pre-scientific subsidiary awareness, one finds on this subsidiary level further centers of tacit integration. This phenomenon points to nothing other than the various occurrences of tacit knowing performed by the different faculties situated prior to the faculty of articulate, scientific intelligence.

In this light, Polanyi's manner of contrasting explicit and tacit knowing becomes comprehensible. For the contrast merely refers to the centers of tacit integration on the levels of inarticulate intelligence, which precede articulate scientific thought. And yet, while this is the case, we must not lose sight of the fact that the pre-scientific faculties are themselves a subsidiary premise, tacitly bound to science in its pursuit for explicit, formal knowledge; a condition which precludes the possibility of a wholly explicit knowledge (S.M., pp. 24, 25).

## 2. Definitions and Explanations: Focal Analysis of Subsidiary Particulars

We are now in a position to consider the most complex aspect of Polanyi's philosophy of science, which appears to designate also the most characteristic mark of scientific inquiry. It concerns itself with the tendency of science to reflect focally on particulars, which have been known through pre-scientific awareness only in a subsidiary manner.

If we turn to Polanyi's analysis of language, particularly in relation to classification, we can begin to understand what the matter of focally attending particulars consists of. Before we continue however, we must briefly recall our analysis of language in which we determined its relationships to conceptions on the one hand, and to the subject matter subsumed under it on the other. It was found that words are always a subsidiary component of

thought supporting conceptions which functioned as their focal integrators. Further, the subject matter to which the words refer was in turn a subsidiary component of language, so that concepts comprehended both the words and their subject matter as their subsidiary parts.

Polanyi distinguishes known classes of things, the properties of which are readily specifiable, from known classes, the properties of which are not readily specifiable. In the latter case, the entire meaning subsumed under the term of the classification cannot be immediately specified. Significant historical utterances, for example, "accumulate through the centuries an unfathomable fund of subsidiarily known connotations," which cannot be readily explicated. In order to do so, one must bring these subsidiary elements "partly into focus by reflecting on the use of such words" (P.K., p. 115). But this will inevitably require the consideration of the subject matter subsumed under the terms. We are confronted here with three consecutive levels of meaning, namely, the subject matter, the term and the conception. The relationship between them is such that the subject matter is subsumed under the term, while both are subsidiary particulars of conceptions, in which they cohere. Thus insofar as words and their subject matter are subsidiary components of conceptions, their analysis will inevitably involve the conceptions themselves. In fact it will result in focally attending the subsidiary particulars of a conception. Hence, to explicitly specify the meaning of a term which has been thus far known only subsidiarily amounts to

an analysis of the conception by which we are jointly aware both of the term and the subject matter, or more precisely, to an analysis of the particulars covered by this conception (P.K., p. 116).

We must remember however, Polanyi's view concerning the necessity of pre-scientific awareness, which demands a knowledge of the entity prior to its subjection to analysis. And this holds true also in the case of defining the meaning of words. It is suggested that before analyzing a term one must be confident in being able to identify authentic cases where the term is used meaningfully (P.K., p. 116). These are occasions in which the term has been known only subsidiarily, i.e., subsumed under a concept. Defining a word, Polanyi explains, is similar to studying the motions involved in using a hammer. If such a study is to be meaningful, one must consider an instance of efficient hammering, in which the motions are purposeful to the overall act. But more important for Polanyi is the fact that the identification of authentic cases is a self-accredited tacit act involving the personal appraisal of the knower. Therefore,

in formulating a definition we must rely on watching the way the art of using a word is authentically practiced; or more precisely, watch ourselves applying the term to be defined in ways that we regard as authentic (P.K., p. 250).

Definition however, remains an analytic focusing on what has been known only subsidiarily. As such it is a formalization of informal meaning. But such formalization is only partial, for the replacement of informal by formal meaning must, at all times, remain dependent on an anterior informal knowledge of the entity which is defined (P.K., p. 115). Although a definition may further elucidate the entity being defined, it can neither exhaust it, nor replace it entirely. In this sense definitions are like maxims, illustrating and guiding an art while relying on the practical knowledge of the art. Such definitions "are, if true and new, analytic discoveries," the pursuit of which is "the most important task of philosophy."

As a consequence of these remarks, we are now led to the important thesis that the formal, definitional knowledge of an entity is not only dependent on the informal knowledge of that entity, but it is also essentially different from it (T.D., p. 20). Polanyi explains that "to take cognizance focally of a subsidiary element of a comprehension is a new experience, and an act which is usually hazardous" (P.K., p. 115). And the result of such focal attention is "in the nature of an explanation."

Finally, Polanyi relates his analysis to the problem of analytic and synthetic propositions. He indicates that the dichotomy between "analytic propositions that are necessary and synthetic statements that are contingent" does not hold. For according to his view of explanation, analytic statements are simply the result of focally attending what has been known only subsidiarily in a synthetic statement of empirical observation. In this sense analytic and synthetic are merely two different ways of knowing the same thing, which as such "cannot be transposed into each other by logical operation" (P.K., p. 115).

### 3. Maxims

#### a. Maxims and Skills

As we saw from the conclusions reached in the preceding analysis, the act of defining things entails a focal reflection on the subsidiary particulars of the object being defined. This holds true irrespective of the nature of the entity that is subjected to definitional scrutiny. With these in mind, we can now look at the status of definitions, insofar as they furnish maxims and principles that have a bearing on various skills and acts of knowing.

From the outset Polanyi asserts that "maxims are rules, the correct application of which is part of the art which they govern" (P.K., p. 31). Just like their application, the derivation of maxims also is originally rooted in the skillful acts to which the maxims are relevant, and of which they form an intrinsic part. On these bases it is then stated that skills cannot be fully accounted for by a mere explication of their particulars (P.K., p. 50). In The Tacit Dimension Polanyi puts the matter as follows:

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 (T.D., p. 20).

Further, maxims cannot even be understood if there is no practical knowledge of the art they explain. Polanyi emphasizes that maxims "derive their interest from our appreciation of the art and cannot themselves either replace or establish that appreciation" (P.K., p. 31). Elsewhere it is suggested that the acceptance of explicit presuppositions, or rules is justified only because such presuppositions are implied in acts which are personally accredited (P.K., p. 162).

From such an analysis Polanyi does not want to conclude, however, that the explicit knowledge of maxims is meaningless. It has been said already that such a knowledge is qualitatively different than the knowledge of the art to which the maxims are relevant. But furthermore, the maxims can be useful also in providing guidance for the practice of an art. However, they can perform such function only under one condition. The maxims must be re-integrated into the act of performing the art, in such a way so as to acquire a subsidiary function, as a mere part of the whole act. To illustrate this phenomenon Polanyi considers the skill of cycling. The maxim for balanced bicycle riding, we are told, establishes that the curvature of the bicycle's path must be adjusted in proportion to the ration of the rider's unbalance over the square of his speed. Obviously, if the rider were to focus his attention on meeting the conditions of such a maxim, his chances of successfully learning to ride would be indeed very slim. In trying to achieve such a complex operation he might even fall off the bicycle (P.K., p. 49). The purpose of this explanation is to show that in the actual practice of a skill a number of other factors are involved not accounted for by the maxim. The maxim itself is merely one of the factors that enters into the art, and as such it is merely a subsidiary component, implying that in the practice of the art it must not be attended focally. Hence,

Rules of art can be useful, but they do not determine the practice of an art; they are maxims which can serve as a guide to an art only if they can be integrated into the practical knowledge of the art. They cannot replace this knowledge (P.K., p. 50).

Polanyi often refers to the phenomenon of integration as a process of "interiorization." In such a process the resultant knowledge from a focal discovery is brought back to one's subsidiary framework. To achieve the interiorization of something, one must dwell in it and identify himself with it, while using it as a reliable ground from which to attend to things. In similar fashion Polanyi speaks of the interiorization of scientific theories by relying on them for understanding nature (T.D., pp. 17, 18).

In the context of the above analysis, we can see how Polanyi's attempt to establish the status of maxims displays two distinct purposes. On the other hand, he tries to show that the explicit knowledge of maxims is essentially different from and ultimately depends upon the knowledge of the skill they explain. On the other hand, he tries to demonstrate that the application of maxims involves their integration into the act of practicing a skill, as subsidiary components. This leads to two important conclusions, which situate his analysis of maxims consistently into his overall methodology. First, the focally explicit knowledge of maxims presupposes an antecedent, pre-scientific knowledge of the reality they explain. And secondly, the functioning of maxims in the realities they explain is only a relative one.

#### b. Maxims and Learning

It appears that most of Polanyi's views on the nature and place of maxims have been formulated in conjunction with close observations of learning situations. His explanation of the learning process attempts to disclose not only the limited function of maxims, but also the actual way in which they operate in real learning situations. He notes that an art cannot be entirely specified through predetermined rules, and as such, it "cannot be transmitted by prescription" (P.K., p. 53). A person therefore, cannot learn a skill by merely following a code of rules. As a minimum requirement the transmission of an art demands personal contact. Traditions of fine craftsmanship did not survive on the basis of prescriptive instruction, but rather by personal example, by watching the master at work. The student must observe his master in an intimate way.

The absence of both example and personal involvement of the learner will ultimately be detrimental to the practical knowledge of the art. Polanyi indicates that while the articulate content of science has been successfully taught all over the world, "the unspecifiable art of

scientific research" has not been learned. While the articulate results of science have been conveyed, the art itself of arriving at such results has not been transmitted. If the traditional continuity of a certain art is broken, the losses are most of the times irretrievable. Attempts to replace certain skills through mechanization have led to not only the obliteration of the practical skill, but also to the realization that mechanical substitutes cannot produce the same results. Purely specifiable processes cannot replace the practical knowledge of the art. A striking example of this is seen in the endless efforts of scientists to reproduce artifacts, qualitatively comparable to those of the art that originally conceived them. Polanyi speaks of the hopeless attempts of scientists to construct a violin through specified, step by step procedures. Rather mockingly, he contrasts their consistent failure with the ability of artisans two centuries ago, who were able to produce excellent violins as a matter of routine (P.K., p. 53).

But there is yet more to be said about the personal manner of learning an art. Following the work of a master, explains Polanyi, involves the recognition and submission to authority. Here again we are reminded of the role of personal commitment in all human knowing. The learner cannot specifiably account for all the details and rules that enter into the art. Yet he gradually assimilates them, even those which the master himself is not explicitly aware of, by trusting the master and following his example. In Polanyi's words,

To learn by example is to submit to authority. You follow your master because you trust his manner of doing things even when you cannot analyze and account in detail for its effectiveness. By watching the master and emulating his efforts in the presence of his example, the apprentice unconsciously picks up the rules of the art, including those which are not explicitly known to the master himself. These hidden rules can be assimilated only by a person who surrenders himself to that extent uncritically to the imitation of another (P.K., p. 53).

Among other things, such an analysis implies a view of learning in which the explicit knowledge of rules is not only relativized, but also proven unnecessary for learning an art. Polanyi himself summarizes his position by indicting that "the aim of a skillful performance is achieved by the observance of a set of rules which are not known as such to the person following them" (P.K., p. 49).

In his essay written in 1964 entitled "The Logic of Tacit Inference", Polanyi compares the acquisition of a skill with coming to know living beings. The latter, he explains, are known by intimately dwelling in the subsidiary particulars of the organism, which are in turn tacitly integrated into a focal whole. Likewise, learning a skill involves the personal indwelling of the learner in the particulars of the master's actions. The mind of the master is understood by mentally combining his actions into the pattern in which he combines them practically. The learner lives subsidiarily in the master's action from which he focuses onto the latter's intentions. With such an explanation in mind Polanyi can thus state that "We experience a man's mind as the joint meaning of his actions by dwelling in his actions from outside" (K.B., pp. 151, 152).

#### 4. Science and its Axiomatization

Thus far we have surveyed Polanyi's main arguments in his attempt to show that the practice of an art and its explicitly asserted rules are mutually irreducible. We have further seen that the formalization of skills is only partial since it consists of focusing on the subsidiary particulars of the skill, which itself is presupposed in its pre-scientific tacit integrity. With these conclusions in mind we can now turn more specifically to science itself, with regard to its own rules and maxims.

In trying to understand Polanyi's theory of science, one is struck by the fact that for Polanyi science is treated as one art among many. It too is a skillful act on a par with other kinds of skillful acts. Whether, in comparison with others, it occurs on a lower or higher level of development, its basic structure remains fundamentally the same when considered from the point of view of a skillful achievement.<sup>14</sup>

The position that science rests on specifiable presuppositions has been suspect for Polanyi from the very beginning. He explains that both scientific procedures and scientific beliefs or valuations are mutually determined by the fact that they occur in the context of personal commitment. A scientist proceeds in accordance to what he expects to be the case. His anticipations are in turn grounded in the acknowledgement that his methodological procedures have actually met with success. Beliefs and valuations therefore, are disclosed as operative constituents at the foundation of scientific inquiry (P.K., p. 161). The grounding of science on explicitly statable rules is consequently rejected. However, more elaboration of the matter is required.

It is said that a premise is by its very nature an affirmation anterior to that which it grounds. "Accordingly," states Polanyi, "the general views and purposes implicit in the achievement and establishment of a scientific discovery are its premises" (P.K., p. 161). And such premises need not be the same as those held at the beginning of the inquiry. What is implicitly presupposed in a scientific operation is thus identified as the premises of that operation. The meaning of this formulation is further elucidated in two ways. First by showing the dependence of science on everyday knowledge, and secondly by paralleling the function of premises in the common knowledge of facts to the function of premises in the scientific knowledge of facts.

In accordance with his view that scientific knowing assumes a prescientific knowledge of its subject matter, Polanyi asserts that scientific facts can only be appreciated on the basis of an ordinary interest which man has in facts. Furthermore, from the thousands of ordinary facts that are known, only a comparatively few are of scientific interest. For these reasons factuality as such is not science. Hence, principles that might account for factuality such as the uniformity of Nature fail to account "by themselves for natural science" (P.K., p. 161). In any case, the knowledge of scientific facts is derived from and remains dependent upon an ordinary awareness of facts.

However, in establishing such a relationship between science and everyday knowledge, one must simultaneously affirm that science rests not only on its own special premises, but also on the premises upon which ordinary facts are established. Consequently a comprehensive account of the premises of science must necessarily include the premises of everyday knowledge. We are here reminded of Polanyi's ascending levels of knowing each of which incorporates within itself previous levels, as elements of its own constitution. All the beliefs and purposes therefore, which are implied in ordinary language are implicitly present also in science. Polanyi explains these relationships in a very concise manner.

Natural science deals with facts borrowed largely from common experience. The methods by which we establish facts in everyday life are therefore logically anterior to the special premises of science, and should be included in a full statement of these premises. The standards of intellectual satisfaction which urge and guide our eyes to gather what there is to see, and which guide our thoughts also to shape our conception of

things--the beliefs about the nature of things transmitted by our everyday descriptive language--all these form part of the premises of science, even though we must allow for the revision of these standards and beliefs within science (P.K., p. 161).

The question must now be raised as to what is the status and nature of premises operative in the everyday knowledge of facts. In answering this question, Polanyi begins by emphasizing the important point that "the premises of factuality are not known to us or believed by us before we start establishing facts" (P.K., p. 162). The actual act through which facts are accepted, as making sense of what one experiences, must be assumed first. Only after the reality of such a process is firmly established can the premises themselves be deduced. No premises can be known in the absence of the procedures they claim to found. The question of premises can be raised only in the face of actual occurrences of fact-discovery. And premises become explicitly known "by reflecting on the way we establish facts" rather than by prescribing the way we should or could establish facts (P.K., p. 162). But the explicit articulation of presuppositions underlying the procedures by which facts are discovered is not in itself the ground of such procedures. For such presuppositions are mere derivations of what has been all along implicitly operative, and implicitly accepted in the act of discovery itself, in which the belief in the existence of facts, as well as the truth of facts, has been already accredited. Consequently, states Polanyi,

We do not believe in the existence of facts because of our anterior and securer belief in any explicit logical presuppositions of such a belief; but on the contrary, we believe in certain explicit presuppositions of factuality only because we have discovered that they are implied in our belief in the existence of facts (P.K., p. 162).

Although the above analysis centers on the premises of everyday knowledge, Polanyi explains that the basic conclusions drawn here hold also for science. Thus, not only are the premises of ordinary knowing implied in science, but the special premises of science itself function in precisely the same way as those of everyday knowledge; i.e., they are implied in the scientific beliefs which enter the actual process of scientific inquiry.

In his reflections on the axiomatization of mathematics, Polanyi attempts to show how the same structure obtains more specifically in science itself. Here too, he indicates that the explicated axioms of mathematics do not in themselves found mathematics. The authenticity of procedures of mathematical discovery must first be assumed. Their premises, in their most original form, on the other hand, are always implicit. The acceptance of them already follows the acceptance of authentic acts in which they are implied (P.K., pp. 191, 192).

The striking similarity between Polanyi's investigation of the premises of science and his analysis of skills should be quite evicent by now. The practice of science, just like the practice of skills can be achieved "without any antecedent focal knowledge of their premises." And the latter can neither be attained nor understood prior to a knowledge of the practical performance of the skill concerned (P.K., p. 162). One's knowledge of antecedent grounds is in the first instance of a subsidiary nature. Hence, as Polanyi evaluates fact finding in both everyday and scientific thought out of such a perspective, he arrives at the following conclusions.

The logical antecedents of an informal mental process like fact finding, or more particularly, the finding of a fact of science, come to be known subsidiarily in the very act of their application; but they can become known focally only later, from an analysis of their application, and, once focally known, they can be applied by re-integration to guide subsidiarily improved performances of the process (P.K., p. 163).

At this juncture, a few remarks must be made regarding the status of focally explicated premises, which will further elucidate the impossibility of grounding skillful achievements, and science in particular, on their respective rules or maxims. As already mentioned, Polanyi indicates that even before one articulates definitions of maxims, he accepts them by tacitly observing them in his practice of scientific inquiry. But such an acceptance is accompanied by an acceptance of the derived results as true, in which the premises of science are implied (P.K., p. 61). Thus,

When certain undefined terms, axioms and symbolic operations are established [formally] as the logical antecedents of mathematics, these are based on the prior assumption that mathematics is true. Our

acceptance of what is logically anterior is based on our prior acceptance of what is logically derivative, as being implied in our acceptance of the latter (P.K., p. 191).

In addition, as in the case of the various skills, the explicit formalization of maxims involves a focal reflection on the implicit, or subsidiary components of the entity under consideration. Thus, granted that the derived results of science are centers of meaning supported by subsidiary premises, an analysis of the latter will entail focal scrutiny on what is implied in the results of science. This line of thought however, leads Polanyi to a very significant and interesting conclusion.

Since the process of discovering the logical antecedent from an analysis of its logical derivative cannot fail to introduce a measure of uncertainty, the knowledge of this antecedent will always be less certain than that of its consequent (P.K., p. 162).

In other words, the subsidiary awareness of premises implied in accepted, derived results exhibits a greater degree of certainty than a formal explication of such premises. For the latter way of knowing the logical antecedents will necessarily include the hazards of focal analytic reflection, which are altogether absent from a mere subsidiary awareness of premises.

Evidently, these arguments run in direct opposition to the popular notion of neutral science, which strives for impersonal knowledge on the basis of prescribed rules. And indeed, it is this very tradition of scientific thought that Polanyi tries to unmask as he posits his own epistemology of personal knowledge.

##### 5. Limits of Scientific Axiomatization and Personal Beliefs

From our analysis of both scientific discovery and the axiomatization of science we have seen that the practice of science is a gift, or skillful activity founded on prescientific as well as scientific personal beliefs. We also noted that, while the premises of science can be presented in the form of explicitly articulated axioms, they remain dependent on an antecedent acknowledgement of their implicit functions in actual scientific activities. In light of these findings one is naturally compelled to ask, what then is the place of formalized scientific axioms? Once the premises of science have been articulated into "objective" axioms, how do they function? Do they have a role to play in science? And if they do, how decisive is that role? As we shall see in what

immediately follows, Polanyi's treatment of these questions will render the role of formal axioms extremely limited, in a way that undermines some of the most fundamental principles of modern epistemological theories. Indeed, the philosophical qualifications that Polanyi brings to bear upon the function of scientific axioms casts the matter in an entirely new light.

The key elements of his position lie in the assertion that the premises of science are found to offer guidance only in the actual practice of science, and in the absence of such a skill they are rendered ineffective. In support of this principle Polanyi points to the fact that no formulation of scientific premises ever led a person, lacking the special gifts of a scientist, to undertake the solution of serious scientific questions (P.K., p. 165). But Polanyi takes it even a step further. For even in the hands of trained scientists, formal methodological maxims were never shown to have the final word in settling burning scientific problems. In mathematics for example, they have never "supplied a formalized organon for the process of future discovery," nor have they ever become "the supreme arbiter in deciding controversial issues in mathematics" (P.K., p. 191).

The many formulas that have been given as an absolute, explicit criterion for scientific inquiry are in Polanyi's eyes merely disguised efforts to conceal the function of personal judgment and commitment. Testing the validity of a theory according to the rule of "simplicity" or that "it works," can in no way eliminate the coefficient of personal judgment. Formulas such as 'simplicity' and 'workability', explains Polanyi, are mere pseudo-substitutes for 'true'. By unmasking, in this manner, the supposed impersonal criteria of science, one is confronted with the fact that

the answer to the question what is simple  
[or what works] in a given case must always  
be exactly as doubtful as the answer to the  
question what is true in the same case  
(P.K., p. 166).

This implies that in deciding whether a specific instance of scientific inquiry meets a formal criterion, a personal judgment is involved, which is itself informal. The latter enters the picture at the point where the specific case is related to the formal rule as its validating criterion. And such relating entails the crossing of a logical gap, akin to the one we found in scientific discovery, the formation of universal and other acts of knowing.

Along the same lines Polanyi criticizes the positivist methods of empirical inference, which claim to prescribe the process of scientific discovery, or demonstrate the verifiability or at least the falsity of an empirical proposition on the basis of specifiable rules. The first claim is rejected in view of the fact that "discovery is separated by a logical gap from the grounds on which it is made." Strict demonstrability of the truth or falsity of a proposition is equally unfounded for Polanyi and this, he is convinced, is evident from the history of great scientific controversies (P.K., p. 167).

In any case, formal rules or maxims neither determine scientific inquiry in a definitive sense, nor are they the sole arbiter of scientific truth. Polanyi further illustrates this by disclosing the ambiguous meaning formal rules acquire when used in an actual scientific inquiry. It is asserted that the meaning of rules varies in accordance with the beliefs to which a person is committed. The usage of rules always occurs in the context of personal commitment which as such determines the way the rules are understood. Hence,

All formal rules of scientific procedure must prove ambiguous, for they will be interpreted quite differently, according to the particular conceptions about the nature of things by which the scientist is guided (P.K., p. 167).

On the basis of these arguments therefore, Polanyi compels his reader to admit that the acceptance of anterior maxims of scientific procedure is based on the prior acceptance of the validity of the procedure itself. As an act of intellectual achievement it entails the tacit integration of implicit or subsidiary premises with focally attended scientific meaning.

In such a context the status of proofs and tests falls under a different light. It has been indicated already that in relating a scientific finding to formal criteria, a personal judgment is involved, which is itself informal. But the limitations of explicit, formal criteria do not stop here, for there is yet another limiting factor. The latter comes into view when one considers the grounds upon which the formal rules of verification have been accepted. Polanyi suggests that the acceptance of a formula as a criterion for formal proofs, relies on implicit beliefs which themselves have not been formally proven. If the attempt is made to prove the reliability of such premises the same problem will surface anew. For in trying to prove the assumptions underlying the formal criteria of verification, one will require a new set of formal criteria, the

acceptance of which is founded on further implicit beliefs requiring in turn their own proof. Any rigorous effort to formally prove all scientific theorems and rules is therefore faced with a receding sequence of informally held beliefs. As a consequence, formal proofs can neither exhaust one's acceptance of an assertion, nor can they themselves be definitively proven. A residue of implicit, unproven beliefs is therefore unavoidable.

Polanyi demonstrates this in his analysis of mathematics, where on the basis of the above grounds he attempts to illustrate the impossibility of a thorough axiomatization of the discipline. Since every formal proof necessarily depends on unproven assumptions, "A fully axiomatized deductive system," he claims, "is like a carefully locked gate in the midst of an infinite empty space" (P.K., p. 191). This line of thought leads Polanyi to the important conclusion that the rejection of beliefs cannot be founded on the fact that they have not been formally proven. For in the light of his arguments, if one were to reject all the unproven assumptions of science, then science itself would be also eliminated. He states,

If the acceptance of any proof requires the acceptance without proof of some presuppositions from which the proof is ultimately derived, it follows that the principle of rejecting any unproven statement in mathematics implies also the rejection of all proven statements and therefore of all mathematics (P.K., p. 192).

We can now see that the effect of formal proof is not only limited by the crossing of the logical gap in the process of inference from formal criteria to testing results, but also by the beliefs implied in accepting a formal criterion from which the proof proceeds.

Polanyi extends these arguments to every scientific discipline, concluding thereby that an exhaustive formalization and axiomatization of the entire body of science is an impossibility. As a summary of scientific knowledge, he explains, explicated maxims are accepted only because one accepts the body of knowledge of which they are the summary (P.K., p. 171). Mathematical knowledge for example, is affirmed by a person by dwelling in it. It entails a passionate involvement on the part of the knower through which mathematical conceptions and assertions are endorsed as tokens of intellectual truth. In the absence of this personal participation mathematics cannot be understood; "its conceptions would dissolve and its proofs carry no conviction (P.K., p. 192). Scientific

knowledge is thus accepted prior to any formal verification of its claims. The entire body of knowledge known as science can never be defined or definitively determined. Even a scientist who masters his own field and can authoritatively verify certain assertions still remains dependent on a vast body of scientific knowledge, which he can neither verify nor evaluate at first hand (P.K., p. 163).

In themselves, therefore, formal maxims can explain nothing, and they are only meaningful from an anterior belief in a body of science in which they are implied. Their personal character is exemplified in the fact that with each significant change in scientific value, there has been a corresponding change in scientific method, which can be formulated in maxims of procedure (P.K., p. 170).

One's acceptance of a body of scientific knowledge involves implications which have not yet been formed and crystallized. But a person believes in the body of knowledge he accepts, precisely because he anticipates the emergence of future discoveries, which would indeed be tokens of the truth. For this reason an explicated statement of the premises implied in science is possible, at best, only of past scientific achievements. The assumptions of present scientific practices remain unformed as their fruits remain to be seen (P.K., p. 165). The truth of an accepted body of knowledge, as we have already suggested, is for Polanyi not its fruitfulness but the intimations of its fruitfulness.

A person commits himself to a belief in a body of knowledge in which he dwells and out of which he envisions reality. He shares such beliefs with a community of men as carriers and innovators of a cultural heritage. He gives tacit and passionate assent to a framework, a vision of reality. "No intelligence," claims Polanyi, "however critical or original, can operate outside such a fiduciary framework" (P.K., pp. 266, 171). Such a tacit acceptance of scientific as well as other kinds of frameworks

have a power to control our own thought. They speak to us and convince us, and it is precisely in their power over our own minds that we recognize their justification and their claim to universal acceptance (P.K., p. 265).

Polanyi's approach to the philosophy of science compels him, therefore, to conclude that "science is a system of beliefs to which we are committed." Beliefs that are rooted in a historical tradition, cultivated by the special community of scientists and supported by a general community at large (P.K., pp. 171, 217-219).

## 6. The Nature of Assertions

The intrinsically personal character of scientific activity and the restrictive limits that personal commitment imposes upon formal axioms decisively preclude the acceptance of strictly objective elements in science. Every component of science, according to Polanyi, remains connected to beliefs that are held through the power of personal commitment. Having expounded upon these fundamental principles of Polanyi's epistemology, we are now in a position to revisit the question regarding the nature of assertions. In light of our preceding analysis we will attempt to give a more detailed account of their place in personal knowledge, particularly as they relate to assertive acts and the beliefs implied in them.

A sincere allegation, claims Polanyi, is an act the agent of which is a person. It is made by speaking or by writing down certain symbols. The execution of such an act is always accompanied by intellectual passions, while the assertions made "express conviction to those to whom they are addressed" (P.K., p. 27).

Polanyi's analysis of assertions proceeds in accordance with a fundamental distinction differentiating the statement in which the assertion is conveyed from the act by which the statement is asserted (P.K., p. 254). Through this distinction Polanyi intends to demonstrate that the meaning of assertions cannot be understood apart from the act by which they are made. This assumption underlies his consistent refusal to deal with sentences as entities in themselves, apart from the modality in which they are intended.

Sentences for Polanyi have an impassionate quality expressing a command, a question, or an allegation of fact. The modality of such sentences is often signified by a question mark, an exclamation mark, etc., depending on what the case may be. To treat sentences, therefore, divorced from the mode of action in which they are asserted is to deal with something that has incomplete meaning.

Polanyi expounds his view by making use of Frege's assertion symbol 'r'. When placed in front of a sentence the symbol intends to designate the actual assertion of that sentence. The actual assertion of a statement p can thus be symbolized as 'r.p' (P.K., p. 27). The question is then raised concerning the authentic meaning of the assertion sign. While recognizing that an unasserted sentence is meaningless, Polanyi presses further to ask what is meant by an actual assertion signified by 'r.p'. But he frames this inquiry in the realization that actual allegations are made by different people, to different

people and at different times. And precisely for this reason any impersonal interpretation of the assertion sign is rejected. Whitehead and Russell's interpretation serves as a good example. For the latter the sign 'r' is interpreted to mean 'it is asserted'. Polanyi objects to this, however, by arguing that such an interpretation replaced the personal character of an actual assertion of a statement with the nonsensical notion that an assertion "asserts itself or is impersonally asserted by nobody in particular" (P.K., p. 28).

The significance of the assertion sign, it is explained, is not to indicate that an assertion is made, but rather to signify that it is believed by the person who made it. It is not the uttering of the assertion that is at stake, but the personal belief in what is being uttered. The sign 'r' designates a fiduciary act by which a statement is made. Hence 'r.p' can be interpreted to mean 'I believe p'. In Polanyi's words:

the significance of my writing down 'r.p' is not that I make an assertion but that I commit myself to it; it is not the act of my uttering a sentence p that I express by 'r.p' but the fact that I believe what the sentence p says. The correct reading 'r.p' written down by me in good faith is therefore 'I believe p', or some other words expressing the same fiduciary act (P.K., p. 28, see also p. 255).

It is further stated that the assertion sign cannot be used as a prefix to 'I believe p'. For insofar as the sign 'r' means 'I believe' it represents a fiduciary act and not a statement that can be asserted. And for Polanyi only statements can be asserted, not acts. The phrase 'I believe' is not a declaratory statement, rather it intends to "seal a commitment, a vouching or asseveration." The symbol 'r' as well as its translation into the phrase 'I believe' "convey in their respective terms the personal endorsement of the sentence prefixed by them" (P.K., p. 29).

In a similar fashion Polanyi analyzes the meaning of the term 'true' when used to accredit the validity of a statement. It is explained that every conceivable assertion of fact can be made by persons either by believing it to be true, or as a lie. The difference between the two cases however, cannot be sought in the statement itself, for it remains the same. Rather, the difference must be sought in the tacit component of such a statement, which is nothing other than the personal act in which the statement is asserted; the statement itself being the focal aspect of

the tacit act. This schema underlies Polanyi's distinction between a truthful statement and a lie. He states that

A truthful statement commits the speaker to a belief in what he has asserted; he embarks in it on an open sea of limitless implications. An untruthful statement withholds this belief, launching a leaking vessel for others to board and sink in it (P.K., p. 253).

In both cases the personal coefficient involving the personal participation of the speaker in what he says, cannot be eliminated. An assertion of fact must be "accompanied by some heuristic or persuasive feeling," explains Polanyi. Otherwise the words would be meaningless saying nothing (P.K., p. 254).

It follows, therefore, that assertions cannot be tested definitively by strict rules, which attempt to bypass the personal character of assertions. Polanyi however, does not intend to imply that tests are altogether meaningless, but only that they do not have the final word. Their employment is only a limited one. He indicates that in an actual assertion one can differentiate the sentence conveying the meaning of the assertion and the tacit act by which it is made. By tentatively cancelling the latter, the sentence, which is now an unasserted one, can be tested in the face of experience. But, Polanyi, emphasizes, the tacit act itself by which the assertion was made cannot be tested. For only statements of assertion can be tested and said to be 'true', not the act. The latter "is an act of tacit comprehension, which relies altogether on the self-satisfaction of the person who performs it" (P.K., p. 254).

Hence, just as in the case of the assertion sign, the term 'true' in the designation 'p is true' simply means that the person asserting 'p' believes in it; he identifies with the content of p. And further, the term 'true' cannot be applied to accredit the designation 'p is true'. For the phrase 'p is true' is neither a sentence that can be tested nor a fact that can be observed (P.K., pp. 254, 255). It represents a fiduciary act, and in Polanyi's eyes an act cannot be asserted. Any attempt to do so, he explains, is as meaningless as trying to "endorse our own signature."

In the same light Polanyi speaks of the range and limits of systematic criticism. As the focal component of tacit knowing on the level of articulation, articulate forms alone can be subjected to criticism,

not the tacit act by which they are made. Articulate forms can be critically surveyed over and over again in a systematic manner, but not the act by which they have been personally accredited and by which they are personally held. For this reason, it is stated that

We should not apply, therefore, the term 'critical' or 'uncritical' to any process of tacit thought by itself, any more than we would speak of the critical or uncritical performance of a high jump or a dance. Tacit acts are judged by other standards and are to be regarded accordingly as a-critical (P.K., p. 264).

Evidently, the actual stating of assertions as well as their critical acceptance are ultimately rooted in acts of tacit knowing which as such can neither be asserted nor exhaustively judged by systematic critique. They entail the personal commitment of the knower, in which assertions are accepted, as they are founded on subsidiarily held beliefs. "Within the framework of commitment," claims Polanyi, "to say that a sentence is true is to authorize its assertion." And in such a context 'truth' extends beyond the character of isolated impersonal statement. "Truth becomes the rightness of an action" (P.K., p. 320).

## G. Commitment II

### 1. The Personal and the Universal

At the core of Polanyi's theory of knowledge lies the personal commitment of the knower. Every aspect of his theory is an attempt to demonstrate the personal participation of the knower in that which he comes to know on the basis of self set standards held with universal intent. This fact has been brought to the fore in numerous ways throughout our analysis. As an indispensable ingredient in the process of acquiring knowledge, personal commitment was found to be operative in most primitive faculties, in the use of language in everyday thought, as well as in scientific activity. Within the latter, the personal participation of the knower was exemplified in the process of scientific discovery, in the formation of universals and probability statements, in the relation between theories and facts, in the contrast between order and randomness and finally at the juncture between scientific activity and its implied premises.

However, Polanyi's continuous emphasis on the personal participation of the knower is consistently complemented by the assertion that the committed knower participates in the acquisition of his knowledge on the basis of self-set standards held with universal intent. By persistently adding such a qualification to the nature of personal commitment, Polanyi marks his epistemological theory with a subtle perplexity the intent of which, as we shall see, is not altogether unwarranted.

Throughout his Personal Knowledge we find various allusions to the apparent paradox in such a position (P.K., pp. 195, 226, 265). How can a person hold with universal intent to what he knows, if what he knows is evaluated and judged by standards set to himself by himself? While fully aware of the dangers of subjectivism, Polanyi himself tries to arrive at a resolution. The dilemma that might appear to surround his epistemology of personal knowledge, he is convinced, can be eradicated by further insight into the structure of commitment.

In the context of showing the continuity between the different levels of knowing, Polanyi has traced commitment, in an evolutionistic way, to the vegetative level (P.K., p. 363). The attempt to resolve the paradox of self set standards assumes this schema, but with further supplements and specifications. The primordial traces of commitment in the gratification of appetites, as well as its more overt operation on the level of intellectual passions, is contrasted to certain experiences that do not involve commitment. The latter are characterized by certain bodily conditions, which although they permeate throughout the whole person entail neither an act of commitment nor a conscious affirmation. For example,

Intense bodily pain pervades our whole person, yet the feeling of such a pain is not an action or a commitment. When someone feels hot or tired or bored, this pervasively affects his state of mind, but does not imply any affirmation beyond that of his own suffering (P.K., p. 300).

The differentiation here is between experiences that are actively and committedly entered upon and those that are merely suffered on a bodily level, which as such are not an activity. The former, which involve also the body, are classed as activities tending towards achievements while incurring the element of risk or failure. The latter exhibit neither of these features. "Achievements" or "rightness of action" do not apply to them (P.K., p. 312).

Precisely at this juncture Polanyi distinguishes between the personal and the subjective. The first characterizes acts that are committedly entered upon, the second refers to bodily sufferings devoid of purposeful achievements. But the significance of this distinction lies in the fact that the personal represents acts of submission, in which the person surrenders to conditions he acknowledges to be independent of himself. In this sense the personal is beyond the realm of subjectivity. Furthermore, the personal is not objective either, for it is an action guided by the passions of an individual. Polanyi describes these relationships in rather definitive terms.

On such grounds as these, I think we may distinguish between the personal in us, which actively enters into our commitments, and our subjective states, in which we merely endure our feelings. This distinction establishes the conception of the personal, which is neither subjective or objective. Insofar as the person submits to requirements acknowledged by itself as independent of itself, it is not subjective; but insofar as it is an action guided by individual passions, it is not objective either. It transcends the distinction between subjective and objective (P.K., p. 300).

It should be noted that since the personal is equated with acts of commitment, which themselves have been traced to the vegetative level, it follows that the categories of subjective and objective belong to a realm lower than the vegetative level, i.e., the bodily.

Thus far, personal commitment has been distinguished from both subjective and objective classifications. Yet this does not entirely resolve the problem of subjectivism. While assuming the above distinction, Polanyi proceeds to further explain the nature of personal commitment. Initially, he indicates that the degree of consciousness by which acts of commitment are made vary according to the level on which they occur. The satisfaction of appetites for example, which lies at the lower end of the intellectual scale, is largely a non-deliberate activity, rather than a conscious act of personal commitment. The same can be said about acts of perception. Such acts, explains Polanyi, though still personal "are those of a person within ourselves with which we may not always identify ourselves" (P.K., p. 301).

At the upper end of the intellectual scale the picture changes. As is the case with the lower levels, the higher levels of intelligence tend to reduce the conscious personal participation, but for quite different reasons. For in the latter case there is a tendency to strive for an ideal which excludes personal judgment as much as possible. It is a striving for that which is beyond the person, under which the person is willing to submit. And the goal of such striving is something that the person readily identifies himself with. As one ascends the intellectual scale, therefore, it appears that there is a move from an inner intent to an outer intent of personal commitment. The two extremes are exemplified by the satisfaction of drives and appetites on the one hand, and high intellectual achievements on the other, as for the example the achievements of science. The first is intended only for oneself, while the second is intended for all (P.K., p. 301).

The two ends of the intellectual scale provide the general matrix within which scientific discovery occurs, but they also furnish the contours and boundary conditions for the structure of commitment. And, more significantly, the two ends of the scale set the coordinates in terms of which Polanyi tries to further cleanse his position from the dangers of subjectivism. How then is this done?

What characterizes the extreme levels of the scale is taken to reflect the two end poles of commitment. Polanyi identifies these as the personal and the universal.<sup>15</sup> As one ascends to higher levels of activity, personal commitment, while continuous with man's most primitive inner cravings, becomes self conscious, as it strives for a universal ideal acknowledged to be independent of itself.

In commitment therefore, we find a correlation between the personal and the universal, as two sides of the same coin. This is Polanyi's way of doing justice to a dual concern which colors his entire theory of knowledge. The first intends to grant a place to the personal participation of the knower in the knowing process. The second tries to establish criteria for knowing, which lie outside the individual knower, and to this extent criteria that are impersonal. For this reason, the correlation is said to be conditioned by a personal desire having an impersonal intention. This inner connection between the two poles of commitment is described by Polanyi as follows.

We have seen that the thought of truth implies a desire for it, and is to that extent personal. But since such a desire is for something impersonal, this personal

motive has an impersonal intention. We avoid these seeming contradictions by accepting the framework of commitment, in which the personal and the universal mutually require each other. Here the personal comes into existence by asserting universal intent, and the universal is constituted by being accepted as the impersonal term of this personal commitment (P.K., p. 308).

This structure is evident, more or less, on all levels of knowing, including science itself. "An empirical statement," it is explained,

is true to the extent to which it reveals an aspect of reality, a reality largely hidden to us, and existing therefore independently of our knowing it. By trying to say something that is true about reality believed to be existing independently of our knowing it, all assertions of fact necessarily carry universal intent. Our claim to speak of reality serves thus as the external anchoring of our commitment in making a factual statement (P.K., p. 311).

In this sense commitment emerges as the only relation in which something is believed to be true (P.K., p. 311). Once again we are reminded of the subsidiary function of beliefs which, within the context of commitment, provide the grounds from which one focally attends to things, in this case via explicit statements of fact; a process which relies ultimately on a-critical foundations.

For Polanyi the above scheme represents a further step beyond the problem of subjectivism. While the subjective implies bodily conditions to which a person is subjected, personal commitment is comprised of "a personal choice, seeking, and eventually accepting, something believed to be impersonally given" (P.K., p. 302). The qualification however, is always made, that, the impersonal standards are known only to the extent to which they are allowed to have jurisdiction over oneself. As impersonal, such standards are said to "pre-exist" only in the sense that they are submitted to, and are allowed to orient one's actions from the vantage point of having been accepted to carry universal import (P.K., pp. 302, 303). Commitment therefore, exhibits what Polanyi calls the "paradox of dedication," in which a person surrenders

to "obligations laid down for himself by himself" (P.K., p. 308).

## 2. Responsibility

Polanyi's account of the structure of commitment, particularly as it attempts to transcend the problems of subjectivism, bears directly upon his notion of human responsibility. Unlike most contemporary philosophical traditions, he situates responsibility within the limits of personal commitment. It is placed between the personal aspiration for truth and the universal intent with which the truth is held. He states that "while compulsion by force or by neurotic obsession excludes responsibility, compulsion by universal intent establishes responsibility" (P.K., p. 309).

In The Tacit Dimension he identifies the personal pole of commitment with responsibility while the universal pole is equated with the truth for which the knower aspires. The two aspects of commitment are hence translated into responsibility and truth respectively (T.D., p. 87). Being responsible, therefore, is seeking the truth acknowledged to carry universal validity. By recasting the effort to escape subjectivism in these terms, Polanyi can state that, "The freedom of the subjective person to do as he pleases is overruled by the freedom of the responsible person to act as he must" (P.K., p. 309).

From such a perspective, it is claimed, personal responsibility rules out all arbitrariness. For in making a decision the responsible person makes his choices in conformity with the universal standard of truth under which he willingly submits. The numerous alternative choices that are available are firmly overruled on the basis of his personal commitment; and the reasons for his desired choices are never entirely specifiable (P.K., p. 312).

Every act, asserts Polanyi, must be timed. "The risk of hesitation," he explains, "must be weighed against the risk of acting hastily" (P.K., p. 314). Yet, although the resultant choice might be eventually a mistaken one the responsible person chooses the best he knows in a given circumstance. Insofar as the necessity of making choices occurs in the context of personal commitment directed to universal truth, the fear of arbitrariness is claimed to be alleviated. "To accept commitment," states Polanyi,

as the framework within which we may believe something to be true, is to circumscribe the hazards of belief. It is to establish the conception of competence which authorizes a fiduciary choice made and timed, to the best of

the acting person's ability, as a deliberate and yet necessary choice. The paradox of self-set standards is eliminated, for in a competent mental act the agent does not do as he pleases, but compels himself forcibly to act as he believes he must (P.K., p. 315).

This is precisely the perspective within which Polanyi locates scientific activity. Throughout his Personal Knowledge one senses a marked effort to delineate the range of scientific competence, while fiercely rejecting the traditional view of science as the exclusive arbiter of reliable knowledge. Polanyi cannot rest with an autonomous science, a science that elevates itself as the supreme authority. Rather, within the framework of commitment, science is given a limited place with a limited competence, relative to and co-authoritative with other kinds of knowing.

Polanyi explains how scientific statements, even for the scientists themselves, are accepted on the basis of authority; an authority which includes, extra-scientific considerations and convictions rooted in the innermost being of man (P.K., pp. 216-219). Total self-determination is for him an impossibility not only in science but in every area of human knowing. Moreover, such a view conforms with his evolutionistic ontology in which each level of human intelligence arises as a response to latent potentialities in previous stages of development (T.D., p. 91). There is hence an interdependent coherence and continuity between the different levels of intelligence, whereby each level of knowing activity is rendered incapable of operating in and of itself.

Polanyi himself confesses that he rejects a number of views posited by the tradition of science. By doing so however, he does not object radically to all scientific authority, but rather acknowledges its relative reliability. As a scientist himself, he claims to be committed to the authority of science, since such a commitment is indispensable for being a scientist. But for Polanyi it is not a commitment to science as the only authority. "I accept," he states, "the existing scientific opinion as a competent authority, but not as a supreme authority" (P.K., p. 164).

### 3. The Stability of Commitment

On numerous occasions in our examination of Polanyi's epistemology of personal knowledge we touched upon the tacit structure of personal commitment. We indicated how subsidiary or instrumental beliefs and focal attention are mutually integrated into an act of tacit commitment. It was also mentioned that commitment exhibits a developmental character through the subsidiary modification of beliefs in anticipation of novelties. Finally we saw how Polanyi evaded the problem of subjectivism by distinguishing the personal from the universal component of knowledge, at the juncture of which human responsibility was also found to lie. All these principles are viewed by Polanyi as necessary conditions qualifying all knowledge. They are conditions upon which human knowledge depends. If we now consider the fact that people hold with a relative degree of certainty what they know to be true, this would imply that the stability of knowledge would depend on the anterior stability of one's commitment. It would hinge upon the interrelational pattern of the structural components of personal commitment. More specifically therefore, stability of knowledge would become contingent upon the stability of subsidiarily held beliefs from which knowledge is acquired and sustained. Viewed in this perspective the stability of beliefs is for Polanyi an exceedingly crucial issue. For it considers the function of commitment in the inescapable existential dimension of confrontation and challenge; a predicament that calls for responsive acts of self affirmation. These relationships together with the personal and universal aspects of commitment provide the background for disclosing another characteristic feature of commitment, namely, its stability.

Before we plunge into our systematic exposition of the matter, however, we need to make a preliminary clarification regarding the general meaning of the term 'stability'. It should be noted from the outset that for Polanyi the stability of commitment is conceived neither in the sense of strict fixity, nor as an unchangeable adherence to eternal truths. Rather the kind of stability he has in mind should in the first instance be understood in the sense of dependability, reliability, trustworthiness, security, certainty, etc. The stability of commitment has nothing to do with absolute and unalterable fixation, but with the capacity of commitment to render itself capable of being relied upon by the person holding it. This meaning of stability should become increasingly evident from the subsequent analysis.

It has been frequently mentioned that the subsidiary beliefs and frameworks (including scientific beliefs and

frameworks) to which a person is committed are for that person comprehensive and all-embracing (P.K., p. 288). Everything that is known falls within the range of one's beliefs and nothing can be known that falls outside of them. This is the pivot around which the different aspects of commitment-stability hinge.

There are three aspects of stability which Polanyi mentions. The first one pertains to implicit beliefs in their power to meet particular objections raised to rival their validity. This feature of stability rests upon the fact that objections against a system of beliefs can be raised only one at a time. A person defending his own convictions deals with such objections precisely in the manner in which they come to him., i.e., one by one. Each objection therefore, is confronted, in turn, with the power of an entire interpretative framework. Moreover the person adhering to the framework continues to hold to it precisely because in his judgment it has thus far performed successfully. The many past instances where novel topics have been dealt with through the framework come to substantiate its validity. They are taken as a witness to the truth of the framework, while strengthening one's commitment to it. By relying on the framework's capability to continue to meet novelties, new objections are taken care of one at a time. In defeating the objections, a person's commitment to the framework is further reinforced; an outcome that is quite contrary to the intentions for which the objections were originally raised. Evidently the structure of commitment exhibits a self-sustained and self-justifying character. Polanyi refers to this phenomenon as the circularity of a system of beliefs (P.K., p. 289).

The second aspect of stability refers to the capacity of an interpretive framework to expand the circle in which it operates in order to explain threatening objections. In meeting difficulties, the system provides elaborations whereby it expands its range of competence and explanation. What is more significant however, is that such elaborations stem from the level of subsidiary awareness, a phenomenon we met also in the modification of frameworks. This particular process in which threatening novelties are explained by compelling the framework to expand, Polanyi describes as the epicyclical structure of a system of beliefs. "All major interpretative frameworks," he explains, "have an epicyclical structure which supplies a reserve of subsidiary explanations for difficult situations" (P.K., p. 291).

It should be noted that in the exposition of the first two aspects of stability, the original tacit structure of commitment is retained. In the first case of the circularity of beliefs, the power of the framework acquired from past applications is operative in the present only in a subsidiary manner. It provides the background from which rival objections are focused upon. In the case of the epicyclical structure of beliefs we note again that the elaborations of a framework originate on the subsidiary level. In both cases the process involves operations that occur between the subsidiary and focal components of tacit commitment.

Finally, the third aspect of stability depends upon the power of a framework in that "it denies to any rival conception the ground in which it might take root" (P.K., p. 291). By "conception" Polanyi does not mean any specific concept, but a view concerning the nature of things. Polanyi illustrates this aspect of stability by reflecting upon the dynamics involved in trying to replace a tribal "supernatural" conception of things with a modern "naturalistic" view. He explains that this can be attempted only by confronting supernaturalists with a series of relevant instances that would substantiate the naturalist belief. However, all the evidence presented will be rendered meaningless for the supernaturalists precisely because they lack the naturalistic concept in terms of which the evidence can make sense. The evidence will then be explained away one at a time. In this way a system of beliefs tends to be stable by resisting its entire replacement with other beliefs.

When conceived in their joint functioning, the three aspects of stability can be said to insulate as well as authenticate one's commitment to a set of beliefs. And to this extent a person's commitment is self-sustained. As Polanyi concludes,

Circularity, combined with a readily available reserve of epicyclical elaborations and the consequent suppression in the germ of any rival conceptual development, lends a degree of stability to a conceptual framework which we may describe as the measure of its completeness (P.K., p. 291).

And Polanyi makes sure to emphasize that such dynamics do not evade scientific knowledge, but rather pertain intrinsically to its normal mode of operation (P.K., pp. 292, 293).

## H. General Anthropology and Cosmology

### 1. Anthropology

From the very beginning of our inquiry we tried to discern the basic structure of tacit knowing in light of the claim that it constitutes the key to understanding Polanyi's thought. We subsequently examined the function of the tacit principle in various levels of knowing and particularly in science. As we moved from lower levels of awareness to the higher levels of articulate intelligence, we also noted that tacit knowing, through an unbroken continuity, was transposed into a personal commitment implying responsibility and universal intent. Though our entire exposition focused primarily on epistemological concerns, both the order and content of our preceding analysis betray a certain anthropological model as well as an overall ontological conception in which Polanyi's epistemology is couched. For the sake of systematic completeness therefore, we will now attempt to outline briefly the more general contours of both his anthropology and cosmology, particularly from the vantage point of their impingement upon his epistemology of personal knowledge.

In trying to approach the specific area of the philosophy of science, we were compelled to mention a number of pre-scientific levels of activity. These were identified as the level of drives and perception, the level of trick learning, sign learning and latent learning, followed by the development of speech, everyday thought and scientific thought. In this order, each level of development was found to exercise a focal coordinating role with respect to the levels of activity that preceded it, and a subsidiary supporting role with respect to the levels of activity that followed it. Hence, at each stage we were confronted with a subsidiary and a focal component, which were in turn tacitly integrated at every consecutive step on the ascending scale of intellectual development. However, this is only a partial picture of Polanyi's anthropological model. For prior to the above differentiation of the various levels of activity exists a primordial and more basic bifurcation; and that is the contrast between mind and body.

This fundamental distinction was already alluded to in our concluding remarks concerning the structure of commitment. It appears that the differentiation between acts of personal commitment and deliberation on the one hand, and non-deliberative subjective sufferings on the other are but a reflection of the anthropological distinction of mind and body. Personal commitment and

deliberate activity have been largely identified with the realm of the mind, while passive subjectivity has been related to the bodily processes, often conceived as mechanical functions.

One should not receive the impression, however, that Polanyi favors a dualistic anthropology. On the contrary, he vehemently resists a definitive disjunction between body and mind. If anything, he tries to hold them together as intimately as possible, even to the point where they are assigned an original unity which precedes their differentiated contrasts. Polanyi's preference for an anthropology that emphasizes unity becomes comprehensible especially when it is seen in conjunction with his evolutionism.

In articulating the close connection between the two basic anthropological constituents, Polanyi states that the "mind is the meaning of certain bodily mechanisms" (K.B., p. 238). Elsewhere, the relationship is expressed in terms of the mind being the life of the body. But the description of the conjunction between mind and body does not stop here. For their relationship is talked about in terms that are not only more convivial with Polanyi's systematic vocabulary, but that are also consistent with his overall philosophical approach. Interestingly enough, mind and body are related to one another in accordance with the internal principles of the tacit dimension. The body, as the lower level of the life of man, relates to the mind as its subsidiary supporter, while the mind, as the higher life of man, functions as the coordinating focus in which the bodily functions cohere. This problem is explicitly dealt with by Polanyi in his essay "The Structure of Consciousness" (1965). Here, he conceives of "the relation between body and mind as an instance of the relation between the subsidiary and the focal in tacit knowledge" (K.B., p. 219).

As a consequence of this anthropological schema Polanyi asserts that "mind and body do not interact explicitly," meaning by this that in the actual relationship the body exercises a subsidiary operation (K.B., p. 223). In its primary meaning the body is that from which one attends to things, rather than an entity at which one attends (K.B., p. 159). In fact its true nature is automatically lost the moment it is viewed in an exclusively focal manner (K.B., p. 238). For Polanyi, the body occupies the lowest and most subordinate level in man's existence, and this is exemplified in his insistence that "our body is the only aggregate of things of which we are aware almost exclusively in such a subsidiary manner" (K.B., p. 214).

The body is conceived of as an entity in which the human personality dwells, and to this extent an "indispensable partner of the mind." "All our conscious transactions with the world," claims Polanyi, "involve our subsidiary use of our body" (K.B., p. 214). It serves to implement conscious intentions. It gives rise to consciousness (K.B., p. 147). In this context one can begin to comprehend the close tie which Polanyi attributes between bodily conditions and the deliberations of a free mind. He states

Every deliberate act of our own relies on the involuntary functions of our body. Our thoughts are limited by our innate capabilities. Our senses and emotions can be enhanced by education, but these ramifications remain dependent on their native roots (P.K., p. 321).

In Polanyi's view free action and involuntary processes are mutually dependent components conjoined in man, as a single unitary entity. To use Polanyi's phrase, "though rooted in the body, the mind is free in its actions" (K.B., p. 238). Human knowing too, assumes the subsidiary presence of the body, and to this extent Polanyi speaks of the "bodily roots of all knowledge and thought" (K.B., p. 147).

Such an anthropology acquires further definitive contours when one scrutinizes Polanyi's conception of the manner in which concrete objects come to be known. In this process the subsidiary operations of the body play a crucial role. It is indicated that

Our appreciation of the externality of objects lying outside our body, in contrast to parts of our own body, relies on our subsidiary awareness of processes within our body (P.K., p. 59).

In this sense the different parts of the body are said to "serve as tools for observing objects outside and manipulating them" (K.B., p. 147). The mind however, does not remain inactive in this process. For in accordance with the principle of tacit knowing the mind focally integrates the particular, subsidiary processes of the body, upon which the external object registers. The most striking example of this comes to the fore in biology, where the object is a living entity. In coming to know living things, it is explained, the mind mentally duplicates the active coordinations that the living

object exercises in regulating its own subsidiary particulars. It involves a re-living of the life of the organism by subsidiarily dwelling in its subsidiary particulars, and by mentally reproducing its focal coherence (K.B., p. 150). The various reactions elicited in the body by an object support the focal comprehension of the object, while being coordinated by the conscious effort to focus upon it. One should note here, that the knowing process presupposes that both the knower and the known share the same tacit structure (T.D., p. 33). As far as the anthropological aspect is concerned, it should also be noted that the knowledge of concrete objects, though dependent on deliberate mental activity as well, entails also an element of passivity on account of the bodily mechanism (P.K., p. 63).

But the knowledge of objects is presented with certain qualifications. For in ascending the various levels of development in the realm of the mind, and thereby drawing further away from bodily conditions, one notes the emergence of a gradual disappearance of external objects; even to the point where on the level of mathematical knowledge all direct awareness of objects vanishes. But due to the original unity of Polanyi's anthropology there does remain a connection between bodily objects and higher mental processes. For this reason he asserts that objects, or experiences, readily available on lower levels, are only alluded to on higher levels of knowing (P.K., pp. 193, 194, 86). Among other things, Polanyi's rejection of any strict correlation between scientific theories and experience is reminiscent of such an anthropological conception.

Thus far we have seen that the most basic distinction in Polanyi's anthropology is that between mind and body, as two stems of a prior unity. And as we already observed the differentiation of various levels of development continues to take place even within the higher life of man, namely, the mind. But the highest level of intellectual development we mentioned was that of scientific thought; the primary concern of our investigation. However, there are levels of human knowing that go beyond scientific thought. Polanyi himself mentions a few, although there is no reason to believe that in his mind there could not be more. In fact, his belief in unlimited human evolution not only prevents him from giving definitive statements on the matter but also compels him to remain open to any possible future developments.<sup>16</sup> Nevertheless, he explicitly mentions at least three stages beyond that of science. The first one pertains to artistic knowing and appreciation. Its relative position is disclosed from Polanyi's assertion that artistic activity is much freer than the work of

the scientist (P.K., pp. 195, 321). Since the degree of personal freedom increases with each consecutive stage of development, it follows that art is higher than science. Morality comes next. Polanyi points out that moral standards involve the human personality in a more comprehensive way than scientific, or artistic activity (P.K., p. 215). Hence morality occupies a higher and more determinative position. Finally there is religion. Although Polanyi does not elaborate on its place in the intellectual scale, he does refer to religion as one of the highest articulate systems of human knowledge, and to this extent it can be ranked next to art and morality (P.K., p. 203).

Our brief survey of Polanyi's anthropology is certainly incomplete. The purpose however was not to give an exhaustive account, but to outline the contours of the presupposed anthropology within which Polanyi expounds his philosophy of science. As far as we have determined, therefore, his general anthropological model can be summarized as follows: Man is a unitary entity exhibiting a basic contrast between body and mind, with the latter bifurcating into further levels of complexity, in the order of drives and perception, trick, sign and latent learning, speech, everyday thought and science, art, morality and religion.<sup>17</sup>

## 2. Cosmology

Polanyi's anthropology is couched in an evolutionistic cosmology. The entire cosmic diversity of things, plants, animals and humans, as well as the various levels of development that each of them exhibits, is conceived as a complex differentiation of activated potentialities traceable ultimately to a common origin. "This part of the universe," asserts Polanyi,

in which man has arisen, seems to be filled with a field of potentialities which evoke action. The action thus evoked in inanimate matter is rather poor, perhaps quite meaningless. But dead matter, that is lifeless and deathless, takes on meaning by originating living things. With them a hazard enters the hitherto unerring universe: a hazard of life and death (T.D., p. 90).

Matter potential with life is therefore the primordial principle of the universe, manifesting its most original beginnings on the so called vegetative level (K.B., p. 234). Man himself is traced back to "the primeval

specks of protoplasm" (T.D., p. 47). At the same time, the interest of evolution is said to be the rise of higher beings from lower beings, and in this context the rise of man is viewed as the principal purpose of such a process (T.D., p. 46). The destiny of man therefore, and for that matter the destiny of the entire universe, begins with living matter (P.K., pp. 387-390).

According to Polanyi, the entire evolutionary process originates with what is called the ontogenetic principle of morphogenesis. It refers to the capability of organisms to develop into full individuals, by the self-regulation and self-adaptation of their own potentialities latent in their constitutive parts. Polanyi attempts to illustrate this principle by pointing to the ability of certain organisms to regenerate into complete individuals even when they are severely mutilated (P.K., pp. 337, 338). As one ascends to higher forms of life, complete regeneration from mutilated embryonic organisms becomes increasingly limited, and this is due to the fact that on higher levels the parts of an organism are more interdependent within the whole (P.K., pp. 355, 356). In any case, the morphogenetic principle intends to demonstrate the primordial structure of life.

According to this principle the evolution of life proceeds by two mutually related processes. First there are the material or mechanical conditions potentially capable of evolution, and secondly there is a regulating principle which governs the material conditions, while inducing the realization of potentialities. The former supports the regulating process. The latter is the principle of action, originality and achievement, coordinating the parts of the organism into a coherent whole. Polanyi suggests that every form of life manifests this basic structure. It is seen in plants, animals, humans and even in objects fabricated by humans, such as machines (P.K., pp. 337, 342, 360). This dual principle of life is also referred to in terms of a rational principle of operation sustained by favorable inanimate conditions (P.K., p. 383).

However, as in the case of Polanyi's anthropological model, though the contrasting differentiation between matter and regulating activity remains the most fundamental, it is not the only one. For as evolution continues on higher levels of life, one observes further differentiated stages. But here too, the basic structure of subordinate, sustaining conditions and higher regulating principles remains.

In this sense Polanyi speaks of each level of life as being subject to "dual control." The first kind of control pertains to laws that govern the entity's constituent elements in themselves, while the second refers to laws that regulate the comprehensive entity formed by the elements. The first concerns the ordering of the parts, the second concerns the ordering of the whole (K.B., p. 233). In this schema the subordinate elements that constitute an entity are identified with prior stages of development, and in this sense the dual structure of life can be recasted in terms of higher levels controlling lower levels as their supportive elements.<sup>18</sup>

At this juncture Polanyi introduces his notion of boundary conditions, as the potential openness of lower levels anticipating the emergence of higher stages of development. The lower levels provide conditions that potentially allow for further evolution, while the actual emergence of higher levels control the open boundary conditions of the lower (T.D., pp. 45, 49). However, there is a qualification to this process in that while the lower evoke the higher levels, they do not determine them (K.B., p. 235). In his essay entitled "Life's Irreducible Structure" (1968) Polanyi conceives of the evolutionary stages as the emergence of additional principles of life, which are, as such, irreducible to any prior principles governing prior levels of development. In Polanyi's view each stage has its own principles of operation.

But Polanyi's explanation of the evolutionary process through morphogenesis, dual controls and boundary conditions is not unrelated to his epistemological principles. For the entire hierarchy of emerging stages of development are ascribed a "from-at" structure, thus relating the evolutionary process to the original principle of tacit knowing (K.B., p. 235). Lower levels are conceived as subsidiary strata from which higher levels emerge. And conversely, higher levels are foci at which or to which lower levels are jointly coordinated (T.D., p. 34). The principles of evolution, just as the principles of anthropology, are identical to the principles of tacit knowing.

In this light Polanyi can summarize the whole evolutionary process as an achievement of tacit knowing. He states:

The first emergence, by which life comes into existence, is the prototype of all subsequent stages of evolution, by which rising forms of life,

with their higher principles, emerge into existence. I have included all stages of emergence in an enlarged conception of inventiveness achieved by tacit knowing (T.D., p. 49).

By defining evolution as an achievement of tacit knowing Polanyi introduces into the process the standard of rightness as well as the hazards of failure. From its primordial beginnings life discloses a striving towards an acknowledged standard of rightness; a process that cannot be comprehended in mechanical, impersonal terms, as is the case with Darwinism (P.K., p. 390). In this context the morphogenetic principle is spoken of as

the primordial member of an ascending series of homologous processes, which cannot be understood except as the resourceful achievement of a comprehensive rightness, and every one of which dissolves altogether in the light of any more impersonal examination (P.K., p. 340).

Furthermore, as the evolutionary process takes on the features of tacit knowing, it displays the character of inventive achievements and originality. In contrast to inanimate entities, all living things are said to exhibit an active center of individuality; a center that grants living beings a life of innovation and originality (P.K., pp. 344, 335). In this perspective, individuality begins on the vegetative level, where all life first appears. But as one ascends the evolutionary scale, the intensity of individuality varies. On the vegetative level the center of individuality manifests itself in its weakest form (T.D., p. 50). With the rise of man on the upper end of the scale, one observes "a continuous intensification of individuality", accompanied by a corresponding intensification of innovative achievements in the face of greater hazards and risks (P.K., p. 395; T.D., p. 50).

Finally, we must note that the emergence of active centers of individuality is also the emergence of commitment and knowledge. The need for commitment arises with life itself. Its evolution ranges from primordial vegetative achievements to personal strivings towards independent standards of rightness held with universal intent. "Commitment," claims Polanyi,

may then be graded by steps of increasing consciousness; namely, from primordial vegetative commitment

of a center of being, function and growth, to primitive commitment of the active-perceptive centre, and hence further again, to responsible commitments of the consciously deliberating person (P.K., p. 363).

In the final analysis, Polanyi's evolutionistic cosmology compels him to couch all manifestations of commitment and knowledge within a field of universal biology. Even the appraisal of responsible commitments, he explains, must be considered "as the extension of an ascending series of biological observations beyond biology, into a domain that may be called 'ultra-biology'" (P.K., p. 363, see also P.K., pp. 339, 377). It is indeed a domain which not only comprehends the various levels of commitment but also touches the very limits of cosmic reality.

## I. Conclusion

### 1. The Spirit of Michael Polanyi

While focusing primarily on his philosophy of science and the role played by commitment, our journey through Polanyi's work has touched upon the most fundamental components of his thought. In our inquiry, his epistemology was briefly related to his general anthropology as well as to his comprehensive ontological conception. This granted our analysis a relative degree of systematic completeness. Therefore, we are now in a position to make some principal assessments regarding the general status of Polanyi's thought, particularly as it is viewed in relation to modern intellectual trends. In other words, where does Polanyi's spiritual allegiance lie?

The general spirit of Michael Polanyi's work cannot be easily identified with any specific philosophical tradition. Any attempt to do so would lose sight of the authentic Polanyi, while forcing him into allegiances, which he himself never accepts whole-heartedly. This is not to say, however, that he transcends his historical context, nor that he fails to borrow relative insights from the various philosophical camps. His general approach, particularly in his philosophy of science, is indeed a very historical one. His own thesis can be comprehended only in the background of his thorough acquaintance with the age-long philosophical controversies that gave western epistemology its present status. The uniqueness we wish to ascribe to the work of Polanyi can best be understood as a fresh orientation to the recurring historical problems of

philosophical epistemology, that have been repeatedly addressed in the course of western civilization.<sup>19</sup>

Polanyi himself admits a relative indebtedness to a variety of schools. His notion of focal and subsidiary awareness can be easily related to gestalt philosophy, while personal indwelling as a mode of knowledge appears quite reminiscent of the existentialist notion of being-in-the-world (T.D., p. 6; P.K., p. xi). The view that science depends on antecedent, unspecifiable powers of thought exhibits an affinity with a phenomenological approach. His emphasis on the active participation of the knower in the knowing process, Polanyi himself admits, can even be related to Kant's categories (K.B., pp. 155, 156). His view of life as an ever-evolving source of potentialities may easily parallel Bergson's vitalism.<sup>20</sup> Yet, while Polanyi openly acknowledges certain structural connections between his thought and various schools of philosophy, which themselves range from analytic philosophy to phenomenology and existentialism, he never identifies his work with any one of them. On the contrary, the accentuation of his differences with the traditional schools tends to eclipse even the accepted similarities. Often, the originality of his orientation does not allow borrowed insights to remain intact. For as they are assimilated and fitted into Polanyi's thought they undergo a dynamic transformation of meaning. They are re-oriented, re-shaped, re-spirited as it were, often to the extent that their affinity with other schools of thought can be spoken of only in an abstract sense.

Though Polanyi's work resists definitive classification in terms of the prevailing schools, the temper of his thought tends to place him closer to some philosophical camps than others. The school of thought towards which Polanyi leans the most is that of Lebensphilosophie. His stress of life as an ever-unfolding process, the originality and resourcefulness of heuristic passions rooted in primitive impulses, the unfathomable potentialities of creative thought and its ability to give birth to great cultural systems in religion, morality and art, all these, can be cited as 'lebensphilosophie' tendencies.

Yet, as one focusses on the main area of Polanyi's concern, namely the philosophy of science, such a classification cannot be held consistently. Unlike lebensphilosophie, for Polanyi, science does not stand as a hindrance to true humanity, as is the case for example with Henri Bergson. Nor does real cultural life come into view when natural science and mathematics are left behind. Rather, science itself constitutes an authentic

avenue of human achievement; not as the exclusive avenue, but as one among many, co-dependent and co-equal with all other cultural expressions of man.

But the uniqueness of Polanyi would elude us if we were to ignore the central role that personal commitment plays in his epistemology. It can be said with ease that personal commitment, understood in terms of its tacit structure, constitutes the most fundamental conception in his entire philosophy. It is the pivot around which all the major theses revolve; it is the axis of his work. And herein lies the originality of Michael Polanyi.

When viewed in relation to the tradition of western philosophy, Polanyi's appreciation of science within the context of commitment appears quite revolutionary, often to the point of being conceived as a threat. This is particularly true with positivism, or for that matter with the western tradition insofar as it adheres to an autonomous view of science devoid of commitment.<sup>21</sup>

But with personal commitment at the core of not only scientific knowledge, but also at the root of all human knowledge, the spirit of Polanyi's epistemology can be closely allied with a tradition, which though it lacks a dominant philosophical presence in the modern world, goes as far back as western civilization itself. We are here referring to the religion of biblical Christianity; not in its Neo-Platonic, Aristotelian, medieval version, or its modern secularized interpretations, but in its original Judeo-Christian sense. In this tradition, man and the entire range of human knowledge rest on a life of faith; a life of commitment determining man's orientation towards the cosmos and sustaining a vision of reality in terms of which man acquires and shapes his knowledge. In the life of man, according to the biblical religion, all knowledge is rooted in personal faith.

Polanyi's view of human knowing sustains indeed a close affinity with this perspective. His plea for reconsidering St. Augustine's view of faith as the source of all knowledge, a position which in his opinion stands directly contrary to Greek thought, seems to further substantiate a connection with the Christian view of knowledge (P.K., p. 266).

But here again, though his epistemology exhibits definitive leanings in the direction of the Judeo-Christian spirit, it cannot be said that Polanyi's philosophy rests entirely upon a Christian foundation. This is particularly the case when his theory of

knowledge is viewed in relation to his overall vitalistic ontology of life, as a self-perpetuating, resourceful impulse of unlimited creative possibilities. However, as much as his epistemology can be distinguished from his general ontology, it may be possible to say that while the former tends to disclose a Christian orientation, the latter tends to betray a Lebensphilosophie orientation. His work combines an epistemology of personal commitment with an ontology of vital life. Hence, if indeed we are to identify the spirit of Michael Polanyi, we can at best speak of an admixture; a synthesis, perhaps, of Christian and Lebensphilosophie spirits.

In this sense, the spirit of Michael Polanyi can be summarized as follows: The destiny of man is located in an ever-evolving universe, in which man himself lively participates through his personal knowledge in the context of his self-accredited commitment. His free development lies in acknowledging the reality of such a commitment, knowing that at any time the requirement for its modification might arise in meeting a novel situation. By being open from and to the reality of his own commitment, man's passionate strivings will be directed increasingly to a greater knowledge of truth and rightness, intensifying thereby his individuality and sense of responsibility through the recognition and submission to standards held with universal intent.

## 2. Appraisal and Critique

### a. The Problem of Continuity and Discontinuity

No doubt, the brilliance of Polanyi's work raises tantamount questions for western epistemology. This does not preclude, however, the further probing of Polanyi's own views. What follows is an attempt to raise certain critical remarks, exposing difficulties and ambiguities that Polanyi's work leaves unresolved. Such questioning however, will not be done from the vantage point of any of the dominant philosophical traditions, but, rather, from a philosophical position which too, like Polanyi's, attempts to go beyond the problematics of western thought.<sup>22</sup>

Our first question concerns Polanyi's view of a stratified cosmos, which in turn relates to the various levels of knowing. Although such an outlook proves quite insightful in dealing with the interpenetrating diversity of the different aspects of knowledge, certain complications arise the moment it is conceived in evolutionistic terms. The mark of evolutionism lies in its assertion that the entire cosmic diversity arises in

genetic fashion out of a common primordial origin. And this view is certainly at work in Polanyi's emphasis on the continuity of the various levels of knowing, as well as in his stress of the primitive prefiguring of higher modes of activity. Simultaneously however, Polanyi insists -- and this is crucial for his anti-reductionistic epistemology -- that each level of reality is irreducible in that no level can be subordinated or contracted to any other.<sup>23</sup> This position however, results in an unresolved antinomy. For how can the different levels be taken as irreducible if they have all emerged in a derivative manner from prior levels of reality. How can one speak of discontinuity while adhering to a continuous genetic emergence of levels, all of which testify to a common origin.

The antinomy of continuity and discontinuity has a consequent bearing also on the structure of tacit knowing. For the same problem is transposed in terms of the relationship between focal and subsidiary knowledge. The view that focal and subsidiary awareness are mutually irreducible appears to clash with the view that higher modes are derived from lower modes of knowing. For example, while articulate intelligence arises by continuous development from inarticulate intelligence, it simultaneously transcends it, even to the point where the latter is comprehended by articulate intelligence as one of its constitutive elements. The higher modes are born from the lower modes, while at the same time encompassing them as an aspect of their own structure.

This kind of ambiguity appears to be the inevitable result of absorbing an entire array of distinct irreducible principles of order, into a single subjective process of biotic growth. Polanyi's difficulty can be resolved only by acknowledging a variety of discontinuous ordering principles, which as such must be retained extrinsic to the processes which they order. Such a schema can safeguard an order of discontinuous principles, as well as a coherent configuration of processes subject to such principles.

#### b. Focal and Subsidiary Awareness

A further question related to tacit knowing pertains to the fact that Polanyi consistently identifies the focal aspect of an act of knowing with the highest mode of knowing operative in that act. To put it conversely, the subsidiary dimension of an act designates levels of awareness that are always lower on the intellectual scale than the dimension pertinent to the focal component of the act. But insofar as we accept a stratified view

of knowledge, the question could be raised as to why the levels located higher than the focal dimension could not also function subsidiarily in a particular act. If lower levels are implicitly operative with respect to a prevailing focal dimension, why couldn't higher levels do so as well? Why, for instance, couldn't a higher dimension, such as the moral or aesthetic, exert implicit determinations on acts with scientific, technical or appetative foci?<sup>24</sup>

Perhaps Polanyi's evolutionism is a hindrance to raising such questions, for in a geneticistic perspective the implicit presence of prior levels of development is more likely to be considered than that of higher ones. The focal-subsidiary conception however, remains a helpful formulation in distinguishing and comprehending the structures of various acts. The extension therefore, of the subsidiary component to encompass the entire range of levels of knowing can not only intensify such an advantage, but can also provide a principle for understanding the interpenetrating coherence between the various modes of the whole realm of human knowledge. And this can be done by upsetting neither the relative position of each mode in the intellectual scale, nor the stratified order of ascending complexity.

c. Scientific Discovery: The Knower and the Known

We must now turn to the process of scientific discovery. Before we bring forth our critical questions, however, we must acknowledge that Polanyi's account of scientific inquiry reveals a courageous break with the traditional view of science. And this can be attributed almost solely to his open declaration of the intrinsic function of commitment in all inquiry. On this score we admit to be in fundamental agreement with Polanyi, and to this extent our subsequent critique must be understood to go beyond the central subject of personal commitment.

The crossing of the logical gap in scientific discovery provides a genuine insight into the nature of individual responsibility, defined in terms of the indispensable participation of the scientist in the knowing process. The various constituents pertinent to discovery however, require further investigation, for it appears that the lack of certain structural elements renders Polanyi's explanation incomplete and even somewhat problematic. It has been said that the crossing of the gap between a problem and its solution requires a commitment to the belief that the solution

exists as a hidden reality accessible from the known data. But now granted the fact that such a commitment is indispensable, can it be said that it alone is sufficient for bridging the gap? Here we must elaborate further.

Insofar as Polanyi admits that the hidden reality exists independently of the knower, it would seem that the gap between problem and solution is also one between the knower and the potentially known reality that awaits discovery. Consequently the bridging of the gap entails the connection between the knower and the hidden reality. The knower therefore, emerges as one pole of the relationship. But as commitment originates with the knower, we are led to the further observation that commitment too, falls in principle on one side of the relationship. The logical gap of discovery is thus found to lie between the committed knower and the hidden reality. And here we are confronted with a difficulty. For how can self-accredited, personal commitment bridge the gap, by being the ground of a relationship in which it itself is one of the relata. The problem concerns the question of what provides the ultimate foundation for bridging the logical gap. And Polanyi's answer throughout his work has been "personal commitment." The critical question in other words is how can the ultimate condition grounding the possibility of the relation between the knower and the hidden reality be founded in one partner of that relation. We are here faced with an antinomy. On the one hand personal commitment appears to be determining the possibility of the relationship, while on the other it operates as a subject within the relationship. At the same time it functions as a condition and a conditioned.<sup>25</sup>

This phenomenon leads to certain consequences with regard to the independent status of the hidden reality. When one pole of the relationship, namely, the committed knower, becomes the final determiner of the relationship, the other pole, namely, the hidden reality, tends to be absorbed into the former. Although Polanyi repeatedly emphasizes the independent and even "pre-existent" status of the hidden reality, in the final analysis such a status designates not an ontic independence and pre-existence but merely a believed one. The actual existence of the hidden reality seems to be reduced to a belief in its actual existence. It must be understood, however, that Polanyi neither admits nor desires such a reduction. The presence of this tension in his thought therefore, must not be conceived in terms of any explicit statements that he makes, but rather as an underlying consequence of positing commitment as the final determiner of bridging

the logical gap between problem and solution; between the knower and the hidden reality.

In this context the notion of 'hidden reality' acquires a rather vague meaning. For while on certain occasions it appears as an independent ontic reality, at other times it emerges as a mere potentiality of the mind. The problem becomes further intensified when one seeks to locate the hidden reality within Polanyi's evolutionistic ontology and anthropology. In the consecutive emergence of intellectual levels, and the actualization of their corresponding potentialities, the hidden reality as an entity independent of the knower is not only lost, but it appears to arise out of the inner resources of the mind. The presence of anything outside the human intellect on the intellectual level becomes indeed quite problematic in an evolutionistic perspective, where higher levels of development are characterized exclusively as the realm of the mind, while the possibility of any "external" reality remains restricted to the lower levels of materiality. These tendencies in Polanyi's thought finally lead to an ambiguous convergence of the hidden reality with the knowledge of its discovery. In this we observe a reduction of the ontic referent of a discovery to its conceptualization by the discoverer.

At this juncture we might appeal to Polanyi's notion of universal standards of truth and rightness as a key to overcoming the difficulty. Couldn't such standards guarantee the respective independence of the knower and the hidden solution which he seeks, while providing an independent criterion for their relationship? Apparently not. For the standards themselves originate from the commitment of the knower himself. Their universal validity has no meaning outside the intent of the person who holds them. The indubitable character of universal standards rests exclusively on the belief of the person who submits to them. Though Polanyi rightly insists that the acknowledgement of universal standards falls within the range of personal commitment, he commits the error of grounding all standards within commitment itself. For Polanyi, it is not so much a matter of universally existing standards that must be submitted to in faith, but rather a faith that adheres to standards with universal intent. In the final analysis the possibility of universal standards outside the human subject cannot be entertained by Polanyi. Personal commitment remains the final arbiter of all truth; the ultimate ground of universal validity.

Polanyi's cautious efforts to distantiate himself from the dangers of subjectivism are not entirely unwarranted, for such tendencies are certainly present in his work. While he correctly exposes the fallacy that an impersonal view of knowledge leads to a universe without a man, we must be very careful, however, lest his personal view of knowledge leads to man without a universe.

Though Polanyi's philosophy of personal knowledge breaks from the traditional views of science in fundamental ways, it still retains some of its problem elements. One should note that our critique of scientific discovery is an allusion to nothing other than the perennial problem of the relation between the knower and the known. And to the extent to which Polanyi has not overcome this difficulty, it can be said that he remains tied to the traditional problematics of western epistemology. With all their differences, both Polanyi's philosophy of personal knowledge and the traditional view of impersonal reason emerge alike in one respect. They both locate the archimedian point of all knowledge within man himself, and particularly within knowledge itself. In this view, acquired knowledge possesses within itself its own criteria of validation. It is self-grounded and thus autonomous. This self-sufficient view of knowledge is the key to not only the epistemological problems of the critical tradition, but also to our critique of Polanyi. By grounding the ultimate condition of knowledge within the knower as one pole of the knowledge relation, not only does the status of the known become problematic, but also the relation between the knower and the known. And finally, in the very attempt to secure knowledge on its own grounds, knowledge itself loses its very anchorage. For to ground something upon itself is as good as not grounding it at all.

#### d. The Problem of Autonomy and Self-Determination

But does this mean, however, that Polanyi adheres to an autonomous view of scientific knowledge? This question requires a 'yes' and a 'no' answer. To be sure, Polanyi's critique against the impersonal, positivist view of science is also a critique against an autonomous view of science. His notion of personal commitment as the central integrator of the various modes of human consciousness provides from the outset a context within which scientific knowing has but a relative place. The reliance of science on pre-scientific knowledge through the mediation of commitment renders science a dependent rather than an independent kind of knowledge.

Yet when we consider the entire range of human knowledge, of which science is but a part, we again end with a self-conditioned realm of knowledge normed by no other standards than those arising out of its own inner resources. They are, as Polanyi would say, self-set standards. We are not criticizing here the self-acknowledgement of standards through personal commitment, but the fact that for Polanyi such self-acknowledgement is the suprema and only standard of knowledge; a position which confines all criteria of truth within the knowing process, in which the truth becomes known.

Polanyi himself does not feel at home with the notion of absolute self-determination (T.D., p. 91). In his sociology he tries to avoid it by speaking of the binding influence of traditions and of communally held, implicit beliefs. In his anthropology he grounds the self-deliberations of the mind on the mechanical, non-deliberate processes of the body. These formulations however, do not alleviate the problem of absolute determination in any radical sense. Even when Polanyi articulates a position of relative freedom through commitment, the problem still remains. In terms of the subsidiary-focal schema of tacit knowing, Polanyi correlates communal beliefs to individual freedom and bodily mechanism to conscious deliberation and contextual limitations to personal freedom. But commitment remains throughout the unifying link between the two contrasts in each correlation. Commitment itself determines the relationship between subsidiary limitations and free deliberations, but it itself has no limiting conditions. It comprehends both limitations and freedom, without itself being limited by anything extrinsic to itself. As the unifying principle of not only his anthropology and sociology, but also his epistemology and entire cosmology, commitment through its tacit structure functions as the ultimate self-determined determiner. In one way, or another, Polanyi ends with a conception of absolute self-determination, whether it be in the entire realm of knowledge, in man as a whole, in society, or in the entire cosmos as an ever-evolving process of achievement.

The problem of autonomy and absolute self-determination becomes even more acute when we consider the close tie which Polanyi establishes between the knowing process and organic evolution. As we saw earlier, the vegetative level of existence provides the primordial spring of all life. It is the first stage where self-set standards of rightness and truth become operative. Here, the process of self-accredited achievement begins (P.K., p. 345). In this light, tacit commitment, as the origin of all knowledge, is traced directly back to vegetative

processes, which they too, have been found to proceed according to the principles of tacit knowing. Such a tracing, it should be noted, does not intend to merely show the relative dependence of knowledge on organic processes, but rather its unbroken continuity with such processes. In the final analysis therefore, knowledge is an achievement of organic evolution (P.K., pp. 375, 380). With this formulation Polanyi has reduced epistemology to a branch of biology. He even goes as far as to state that

The whole ontology of commitment and of a free society dedicated to the cultivation of thought by responsible commitments of its members can in fact be built up, in this manner, as a generalization of biology followed by reflection on this generalized biology (P.K., p. 380).

While bearing in mind the ambiguity in Polanyi's attempt to hold simultaneously to the principle of discontinuity, we observe a tendency in his thought to comprehend human knowledge as a version of organic functionality. And if we can consider this phenomenon in the context of his overall ontology, we are compelled to conclude that not only knowing but also being in its most comprehensive sense exhibits a single, homogenous order of biological achievement. But as the origin of all life, including knowledge, the process of organic evolution retains from its primordial beginnings a self-accredited, self-determined course. Any discussion regarding limiting conditions, standards of truth and rightness, responsibility and accountability is ultimately undertaken in the context of a prior acceptance of an autonomous, self-sustained organismic universe. Man's entire being is situated in a cosmos the existence of which is upheld and maintained solely through an inner principle of organic life.

Yet, Polanyi's attempt to establish responsible freedom on the basis of standards of truth and rightness must be judged as an authentic one. His efforts are indeed consciously directed against the fallacy of absolute self-determination, a position that would eventually lead to relativism. But how he can meaningfully speak of accountability and responsible freedom in an autonomous cosmos remains a problematic question. At this juncture it would appear that Polanyi's commitment to evolutionism stands in the way of his very effort to establishing reliable standards before which the exercise of human freedom would be accountable.

## e. Truth, Commitment and Evolutionism

Finally, we must note how the autonomy of human knowledge occupied with an evolutionistic ontology exert a shaping influence on Polanyi's view of truth. In science, the truth of a theory has been defined as the intimation of its anticipated fruitfulness in accordance with self-set standards; a view that places truth in a genetic perspective. A view of truth that emphasizes anticipated expectations, from the vantage point of the developmental character of knowledge, can be quite helpful, particularly when considering one's commitment to a specific framework out of which he intends to proceed, or even a communally held commitment orienting a group of people. But what account can be given when considering two rival commitments involving opposing frameworks with mutually exclusive orientations? Although Polanyi clearly recognizes the radical gulf that exists between conflicting commitments, it appears that his view of truth falls short of accounting for such a phenomenon. His explanation would only go as far as to say that the two parties are committed to different views of truth. But if the history of human knowledge, including science, emerges as a continuous process of evolution in accordance with self-set standards, what meaning is there in speaking of conflicting views of truth? If the standards for each view of truth are ultimately immanent to the knowing process in which they are held, how can the conflict between two frameworks be entertained in any serious way? For if each position evolves in terms of its own self-set standards by what legitimacy can one speak of truth? What certifies, for example, Polanyi's critique of positivism and the presentation of his own position, if standards of truth are acknowledged to arise exclusively out of one's own commitment? Polanyi often speaks of moving from a true position to a "truer" one, and this might be legitimate within a single framework. But what is the meaning of conversion, about which he so ardently speaks, which entails the entire rejection of one position for another? Can it be said that a person is converted to the truth in, say, his scientific orientation? Can we even speak of a person living in a lie? Polanyi would say that such judgments are legitimate only in the context of one's own commitment. But we must wonder as to how serious and radical such judgments can be, if the person making them knows that in doing so he relies on standards the indubitable validity of which hinge entirely on having set them to himself, by himself and for himself?

By locating the ultimate criteria for truth within an evolutionary process of knowing, through commitment, Polanyi's position leads to an impasse. On the other hand, his acknowledgement of the radical antithesis between rival commitments leads him to speak of them as mutually exclusive and separated by a logical gap. On the other hand, the self-accredited evolution of knowledge tends to relativize the gulf between conflicting positions, even to the point where differences in basic commitment are absorbed into a universal organismic process of adaptation and assimilation. Evidently Polanyi's insistence on the radical character of personal commitment appears to be counteracted by his self-determined evolutionism.

The various problematic aspects in Polanyi's philosophy can be captured in terms of one basic question. And that is: what is the place and nature of the ultimate ground of being? The problem of continuity and discontinuity in the different levels of reality, the ambiguous relationship between the knower and the known, the autonomy of knowledge and absolute self-determination, the self-sufficiency of commitment, all these, can be looked upon in terms of the principal question of the ground of being. For Polanyi the ultimate foundation of all existence, and consequently of human knowledge, is found in an originally organic potentiality of inorganic matter, which brings forth in man its loftiest achievements by the development of consciousness through the mediation of tacit commitment. In all this the ground of being is part of being itself. The standards, or norms governing the various processes and activities are intrinsic to the processes and activities themselves, rendering them thereby autonomous and self-sufficient. The tracing of all levels of reality to a common organic origin results in a self-determined evolutionism. The accountability of the knower to nothing other than his own self-set standards renders the independence of the known arbitrary. Together with the self-sufficiency of personal commitment we observe a tendency towards an autonomous and self-grounded view of knowledge.

Our own solution to these difficulties lies in the acknowledgement of an interrelated but discontinuous array of norms and standards, which while ordering the many facts of creaturely reality remain extrinsic to the processes which they govern. We are not speaking here of another world or realm populated with static Platonic norms. Rather we are speaking of norms as the correlate condition for the possibility of all creaturely life. As such, these norms are neither being itself nor a part of being, but the condition for being. Further, their impingement upon reality is not one of

strict determination, but one of calling to be. Their demands are callings for free responses. They do not fulfil themselves by some necessary coercion of their subjects. But insofar as they are standards for the well-being and doing of their subjects, they provide the conditional ontic context in which their subjects are to freely meet them; a dynamic process in which we encounter the realization of as many possibilities as the history of mankind and of the entire cosmos exhibits.

At this point we must admit that our own position is inspired by the world and life view of biblical Christianity. In biblical terms the conditioning norms for the entire being of the cosmos are called 'the Word of God', revealing the further fact that such norms do not hold by themselves, but are the decrees of God through which he created and sustains the cosmos.

In returning to our main topic we may now proceed to show how in acknowledging the reality of independent standards, as the correlate condition for all creaturely reality, the problematic aspects in Polanyi's thought can be eliminated. The principal discontinuity of the various levels of reality can be appreciated by recognizing the conditional ordering of a discontinuous series of norms. The dynamic and interpenetrating processes that occur under such norms can be equally appreciated by acknowledging that such processes though subject to such norms are both irreducible and distinct from them. Further, the knower and the known do not only retain their relative status with respect to the norms that hold for each of them, but also the active relationship of the knower to the hidden reality becomes accountable to norms that do not originate from the knower. His personal commitment to standards of truth grant genuine orientation in his inquiry only to the extent to which the standards he acknowledges are in line with the independent norms that pertain to his specific scientific procedure. With our philosophy of independent conditional norms the ambiguity of autonomous knowledge and absolute self-determination is also eliminated.

And finally, the structure of commitment itself falls under a somewhat different light, for commitment too, cannot be self-sufficient. The need for committing oneself to standards with universal intent does not originate, in our view, as an inherent necessity in the personal pursuit of knowledge. Such a need rather originates as the human response to the demands of a normative calling, in which man must make an assessment as to what the nature and requirements of the norms are. The final criterion for the truthfulness, and hence anticipated fruitfulness of one's commitment, is

thus not the acknowledged standards of a person's commitment, but whether his commitment acknowledges the requirements of the independent conditional standards pertinent to his activity. Knowledge of the truth is therefore a dependent affair. The truth is known by submission through personal commitment by acknowledging the norms that reveal the truth. To be sure, and Polanyi recognizes this, the norms of the truth become known only by believing in them. But what one believes the standards for truth to be is not the ultimate criterion for truth; even when we hold to them with universal intent.

f. Michael Polanyi: A Significant Contributor to Epistemological Theory

In spite of the above criticisms however, Polanyi's work stands as a commendable contribution to western philosophy. His originality lies primarily in the area of epistemology, particularly when compared with the various traditional theories. His emphasis on responsibility, his appreciation of personal involvement in the knowing process, his recognition of frameworks and other aspects of his thought can be related in a certain abstract sense to different schools of thought, but not the boldness by which he speaks of personal commitment, particularly as it operates within science. Unlike the predominant epistemological theories, Polanyi acknowledges the function of commitment as an intrinsic and necessary constituent of all scientific knowledge. Personal commitment is not merely a dimension or level of human consciousness, nor does it belong to a separate realm of values above and beyond scientific knowledge. It is rather the root from which all knowledge proceeds; ranging from the most simple cases of sentient awareness to the most complex achievements in science, art, morality and religion.

For all those who ally themselves in principle to the western philosophy of critical reason, such a position is indeed quite embarrassing. But not so for Polanyi. And herein lies the uniqueness of his position. For to the extent to which his position rests on the assertion that the entire spectrum of human knowledge proceeds from personal commitment, to that extent he diverges from western epistemological theories.

Being fully aware of the great historical epistemological controversies, Polanyi offers his own position as a facilitating methodology for healing the epistemological sickness we have inherited from the past. His theory of Personal Knowledge is presented as an alternative to medieval uncritical dogmatism as well as modern

critical rationalism (P.K., p. 265). In Polanyi's view both the authoritarianism bred by dogmatism and the methodological doubt of scientism demanded by critical reason fetter human thought and mutilate responsibility. Polanyi's plea to recognize the reality of personal commitment in all human knowledge is offered instead, as the purposeful and legitimate ground for responsible freedom in all human endeavors, including science itself.



## Notes

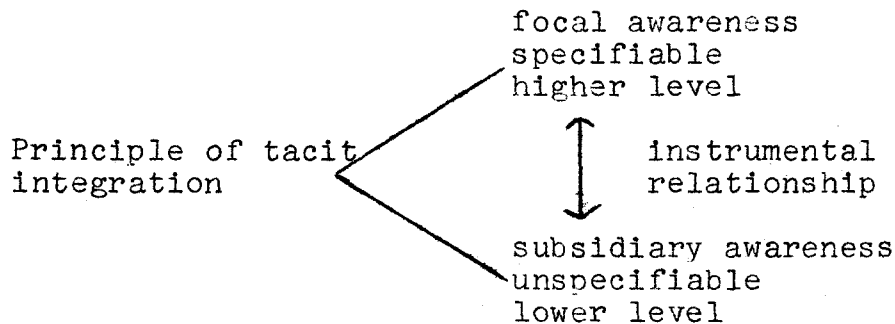
<sup>1</sup>It should be noted that in Polanyi's earlier works, such as Science Faith and Society (1946), the term "tacit knowing" does not appear. As the central philosophical conception, the principle of tacit knowing comes to the fore in Polanyi's mature thought as found in his Personal Knowledge (1958).

<sup>2</sup>In his analysis, E. Pols approximates the original, unitary character of tacit knowing as he refers to both subsidiary and focal operations as tacit. See Edward Pols, "Polanyi and the Problem of Metaphysical Knowledge," Intellect and Hope (Durham, N.C.: Duke University Press, 1968), p. 68.

We must admit that on the epistemological level no text can be found in Polanyi's work that explicitly and definitively establishes the existence of an irreducible, original principle of unity. The tendency however, to assign a primacy to unity is certainly at work here. But for a more substantial proof we need to wait until we consider Polanyi's epistemology in relation to his ontological conceptions.

<sup>3</sup>H. Kuhn relates Polanyi's instrumentalism to certain typical conceptions found in Plato and Aristotle, particularly as they take their point of departure from the Greek notion of techne, in which the artist is said to use means to achieve certain ends. Although this structural similarity exists, it is very doubtful as to whether Polanyi partakes of the Greek spirit as much as Kuhn attempts to show. See Helmut Kuhn, "Personal Knowledge and the Crisis of the Philosophical Tradition," Intellect and Hope, pp. 124, 125.

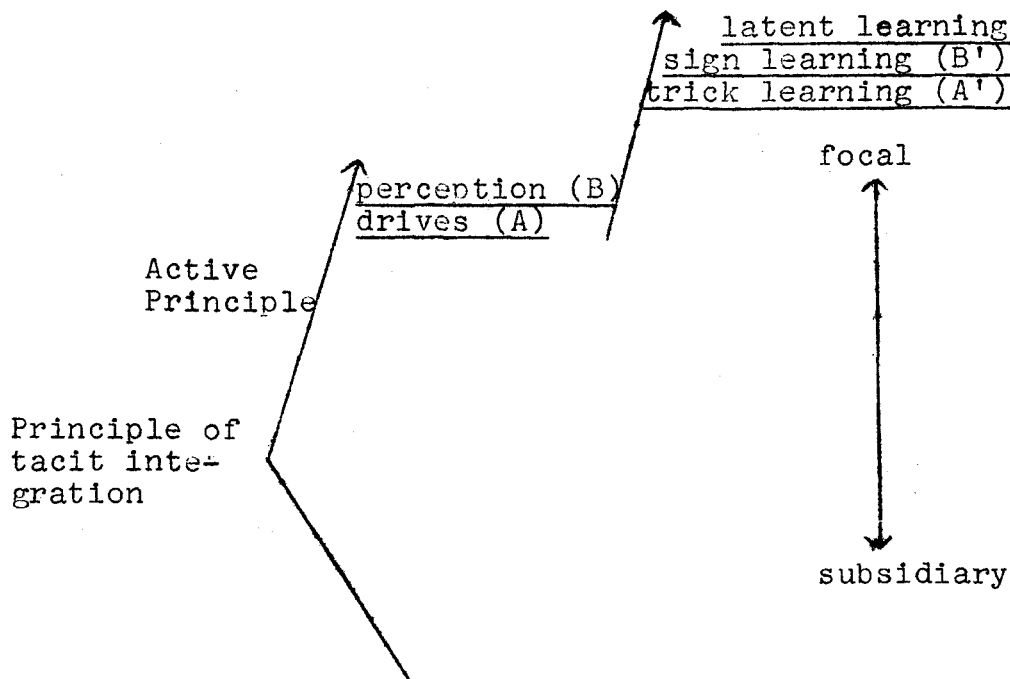
<sup>4</sup>In the light of our analysis, the basic structure of tacit knowing can be schematically conceptualized in the following manner:



<sup>5</sup>Helmut Kuhn, "The Crisis of the Philosophic Tradition," Intellect and Hope, pp. 119, 120.

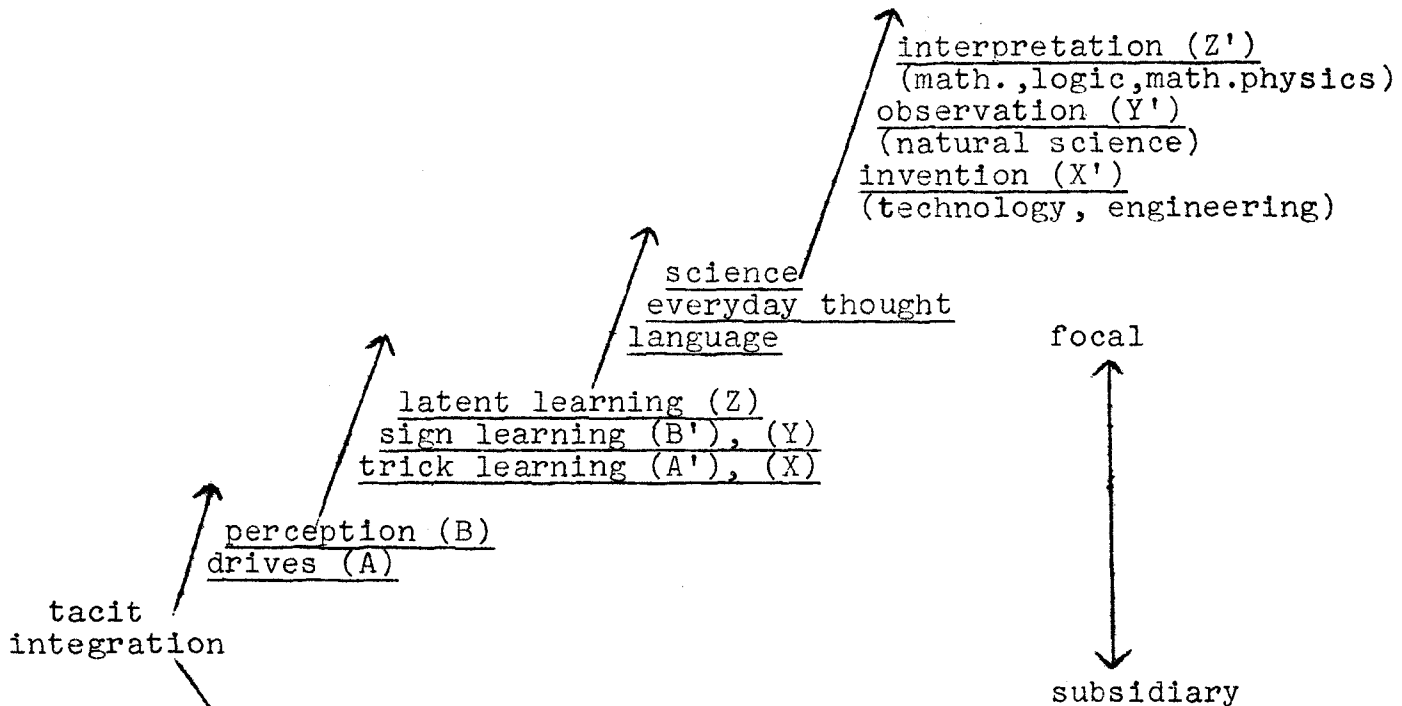
<sup>6</sup>On account of Polanyi's evolutionistic perspective, it remains ambiguous as to whether the higher faculties are merely the lower ones developed, or originally new levels of behavior. It appears, paradoxically, that both are held by Polanyi. This is particularly evident in his essay "Life's Irreducible Structure." See K.B., pp. 225, 239.

<sup>7</sup>The structural interrelationships presented thus far can be represented as follows:



<sup>8</sup>We must tentatively mention at this point that the contrast often found in Polanyi's work between tacit and explicit knowledge must not be understood as an ultimate distinction. Polanyi himself indicates that the "distinction between subsidiary and focal knowledge. . . transcends the distinction between tacit and explicit", see S.M., p. 30. For this reason it is equally misleading to identify tacit with subsidiary, for the latter as we saw is only one aspect of the former. As we shall see, explicit knowledge merely refers to the focal moment of articulate thought, while tacit refers to its integration with subsidiary awareness, which, itself includes tacit centers of integration on lower, inarticulate levels of intelligence. See also E. Pols, "Polanyi and the Problem of Metaphysical Knowledge," Intellect and Hope, pp. 68, 69.

<sup>9</sup>Our schematic representation of the structure of Polanyi's thought can now be extended in the following manner:



This does not imply that Polanyi has no place for the Humanities. Our concern here is merely to identify the level of articulate intelligence at which scientific thought becomes possible. See also footnote 13.

<sup>10</sup>Due to Polanyi's evolutionistic perspective, which emphasizes the continuity between the various levels of knowing, it remains ambiguous as to whether passions and pre-scientific interest belong in principle within or without science.

<sup>11</sup>For a comparative contrast between Polanyi and a representative proponent of the "critical tradition" see "Max Weber and Michael Polanyi," The Logic of Personal Knowledge (London: Routledge and Kegan Paul, 1961), pp. 99-115.

<sup>12</sup>Polanyi has often been criticized for his interpretation of St. Augustine. H. Kuhn for example, calls Polanyi's interpretation "paradoxical." He states, "Just as Descartes had to reaffirm the possibility of attaining truth in the face of Montaigne's scepticism, so Augustine before him was confronted with the universal doubt as propagated by the Academy. The very formulae with which Descartes warded off the attack by laying down the indubitable truths of self-knowledge were anticipated by St. Augustine... If the recognition of doubt as a

heuristic principle is considered the distinctive mark of a 'critical' approach St. Augustine should rather be given the title of initiator of critical philosophy." See Helmut Kuhn, "Personal Knowledge and the Crisis of the Philosophical Tradition," Intellect and Hope, p. 125, fn. 25.

Although these criticisms are quite valid for the early Augustine, they cannot be applied with equal force when considering the mature Augustine. Polanyi's reference to St. Augustine is based on one of his later works, De Libero Arbitrio. Besides having moved away from a preoccupation with the epistemological skepticism of the Academics, Augustine, though not entirely liberated from the epistemological starting point, modifies his theory by asserting that believing faith is the foundation of all knowledge.

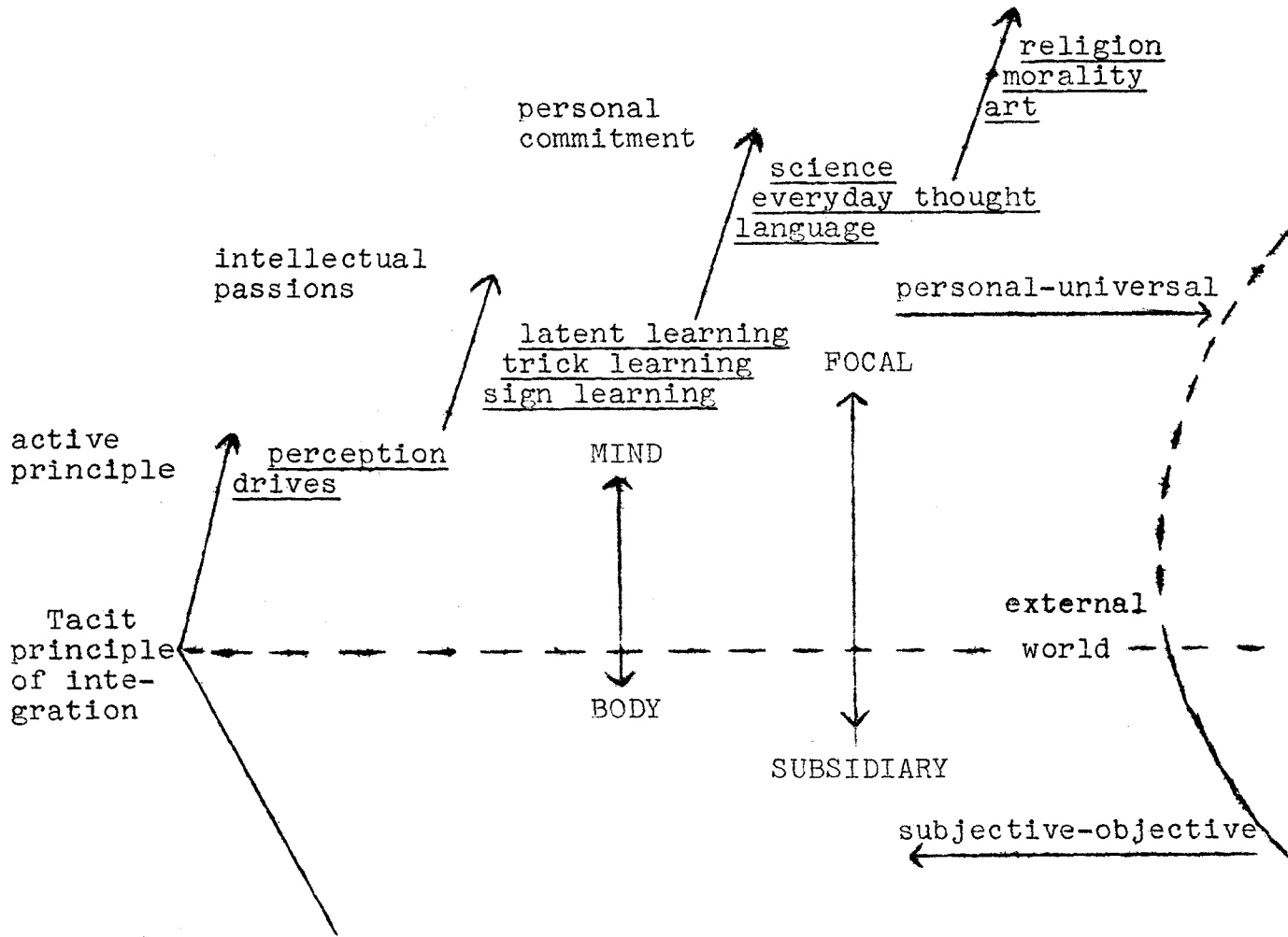
<sup>13</sup>This schema is used by Polanyi as a key for bridging the disjunction between "arts and sciences." The gradient of intrinsic interest over systematic relevance provides the basis for an ascending order of disciplines, in which both variables are involved. The lower sciences, though more systematic, still exhibit intrinsically interesting, unique individualities. The subject matter of the higher sciences on the other hand, while dominated by intrinsic interest and individuality, still retain systematic patterns. In this perspective, the personal participation of the scientist in the various fields, though intensified in the higher sciences, is never altogether absent from the lower sciences. See S.M., pp. 84, 85.

<sup>14</sup>Jiri Kolaja, "A Review of Personal Knowledge," The Personalist, XL (October, 1959), 308.

<sup>15</sup>In many cases Polanyi uses the term "personal" in a more comprehensive sense, than the one implied in the technical distinction contrasting the "personal" and "universal" poles of knowledge. He often employs the term "personal" in ways that encompass the "universal" as well.

<sup>16</sup>Polanyi himself points out that due to the ever expanding horizons of human knowledge, and its subsequent effect on man, a comprehensive knowledge of man's structure appears impossible. See S.M., p. 12.

<sup>17</sup>As far as it is possible to determine, Polanyi's overall anthropological model corresponding to his epistemology of personal knowledge can be represented in the following diagram:



<sup>18</sup> E. Pols analyses Polanyi's notion of "levels of reality" in light of the question as to whether Polanyi's view grants access to metaphysical knowledge. It appears, however, that Pols' analysis falls into a different universe of discourse, bypassing altogether what Polanyi intends to mean by levels of reality. By asking Kantian questions out of a monarchian framework, Pols seems to miss Polanyi entirely. In Polanyi's philosophy the meaning of "levels of reality" does not designate a noumenal, metaphysical order of being(s), nor does it have anything to do with the limits of predication in the Kantian sense. It simply refers to the order in which concrete and existentially identifiable entities exhibit various modes of functional behavior. Hence the question as to whether the different levels of reality will ever reach a metaphysical, noetic "Being itself" is in this context quite irrelevant. See Edward Pols, "Polanyi and the Problem of Metaphysical Knowledge," Intellect and Hope, pp. 74, 84, 86.

<sup>19</sup>Some reviews have characterized the uniqueness of Polanyi's work as a "novel interpretation," or an "unusual point of view." See Edward MacKinnon, "A Review of Personal Knowledge," Modern Schoolman, XXXVI (May, 1959), 294-296; William T. Scott, "Polanyi's Theory of Personal Knowledge," The Massachusetts Review, III (Winter, 1962), 349-368.

<sup>20</sup>Helmut Kuhn, "Personal Knowledge and the Crisis of the Philosophical Tradition," Intellect and Hope, pp. 111, 112.

<sup>21</sup>Most reviews and criticisms of Polanyi seem to ignore the central role that commitment plays in his epistemology. At best, commitment is either incidentally mentioned, or reduced to inventiveness, creativity and in certain cases to a kind of irrationalism. It appears that in the context of western rationalistic philosophy, the seriousness with which Polanyi speaks of personal commitment is basically resisted. The old belief in the incompatibility of faith with philosophical integrity seems to cast its shadow over a number of interpretations of Polanyi's work. See Chaim Perelman, "Polanyi's Interpretation of Scientific Inquiry," Intellect and Hope, pp. 235, 240, 241; Edward MacKinnon, "A Review of Personal Knowledge," Modern Schoolman, XXXVI (May, 1959), 294-296; C. H. Whitely, "A Review of Personal Knowledge," Mind, LXVIII (October, 1959), 556-559.

<sup>22</sup>I am here referring to the Christian, Reformational philosophy as developed and articulated by H. Dooyeweerd and D.H.Th. Vollenhoven at the Free University of Amsterdam.

<sup>23</sup>For a concise exposition on this matter see "Life's Irreducible Structure," K.B., pp. 225-239.

<sup>24</sup>The problem discussed here should not be confused with the tendency of scientific thought to analyze subsidiary particulars while implicitly acknowledging the focal coherence of the entity being examined. The problem does not pertain to the object of knowledge, but to how the various levels of knowing operative in the personal acts of a knowing subject are interrelated.

<sup>25</sup>Although one may question both his working perspective and the conclusions he arrives at, E. MacKinnon in his review of Polanyi's work exposes this epistemological ambiguity between knowledge and reality. See Edward MacKinnon, "A Review of Personal Knowledge," Modern Schoolman, XXXVI (May, 1959), 294-296.

## BIBLIOGRAPHY

Books and Essays by Michael Polanyi

Knowing and Being. Essays by Michael Polanyi. Ed. Marjorie Green. Chicago: The University of Chicago Press, 1974.

Personal Knowledge. New York: Harper Torchbooks, 1964.

Science, Faith and Society. Chicago: University of Chicago Press, 1946; London: Oxford University Press, 1946; Chicago: Phoenix Books, 1964.

The Study of Man. Chicago: University of Chicago Press, 1959; London: Routledge and Kegan Paul, 1959; Chicago: Phoenix Books, 1964.

The Tacit Dimension. Garden City, New York: Doubleday and Company, 1966.

Books and Articles on Michael Polanyi

Crosson, F. "A Review of Personal Knowledge," New Scholasticism, XXXV (April, 1961), 258.

Ignotus, Paul, et al. The Logic of Personal Knowledge. Essays Presented to Michael Polanyi on his Seventieth Birthday, 11th March 1961. London: Routledge and Kegan Paul, 1961.

Intellect and Hope. Essays in the Thought of Michael Polanyi. Ed. Thomas A. Langford and William H. Poteat. Durham, N.C.: Duke University Press, 1968.

Kolaja, Jiri. "A Review of Personal Knowledge," The Personalist, XL (October, 1959), 397-398.

Langford, Thomas A. "Michael Polanyi and the Task of Theology," Journal of Religion, XLVI (January, 1966), 45-55.

MacKinnon, Edward. "A Review of Personal Knowledge," Modern Schoolman, XXXVI (May, 1959), 294-296.

Mukherjee, Nirmal. "Belief and Knowledge," The Radical Humanist, Calcutta, April, 1963, pp. 181-182, 184.

Robin, Richard. "A Review of Personal Knowledge," Philosophy and Phenomenological Research, XX (March, 1960), 429.

Scott, William T. "A Course in Science and Religion Following the Ideas of Michael Polanyi," The Christian Scholar, XLVII (Spring, 1964), 36-46.

\_\_\_\_\_. "Polanyi's Theory of Personal Knowledge: A Gestalt Philosophy," The Massachusetts Review, III (Winter, 1962), 349-368.

Van Lennep, D. J. "A Review of Personal Knowledge," The British Journal for the Philosophy of Science, XI (February, 1961), 344-345.

Whiteley, C. H. "A Review of Personal Knowledge," Mind, LXVIII (October, 1959), 556-559.

Ziman, John. "The Two Towers," The Cambridge Review, October 21, 1961, pp. 33-37.

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