MICHAEL POLANYI ON THE PROBLEM OF SCIENCE AND RELIGION

by Bruno V. Manno

A paramount problem that has plagued any attempt to formulate a viable perspective on the relation between science and religion has been the subjective-objective epistemological dichotomy that has dominated Western philosophy, certainly since Descartes and even before in different ways. This dichotomy has become the starting point for discussing what the epistemological foundations of modern science claim to be. True knowledge is viewed as objective and detached from all stain of human involvement and participation. On this presupposition, science is seen as a convenient summary of given facts or as a strict mathematical relation between observed data.[1]

While there have been some protestations to this view, most of modern epistemological thought has gone on to accept this doctrine of nonparticipation in the act of acquiring knowledge which is set at the center of modern positivistic perspectives on science and articulated by its dispensers of virtue, the philosophers of science, as the paradigm case for all knowing.[2] This positivistic view of science and the world has resulted in the production of a mechanical, denatured conception of man, history, and the universe, and has denied any grounds for allowing freedom of thought. Implicitly, it has also laid the groundwork for the morally destructive tendencies that continue to menace contemporary culture.[3]

It seems to me that any attempt to construct a viable perspective on science and religion must first squarely confront this subjective-objective epistemological dichotomy and attempt to refute it on its own grounds—that is, by offering an alternative philosophy of science that challenges the claim of the positivists concerning the strict objectivity of knowledge.

I believe the writings of Michael Polanyi set forth an alternative philosophy of science that provides this challenge. His perspective

Bruno V. Manno, S.M., is a student in the interdisciplinary doctoral program of Boston College.

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releases the human person from a destructive slavery to a false ideal of human knowing and offers a framework within which a humanistic analysis of culture and, more specifically, the scientific and theological tasks can be pursued.

In all of his writings Polanyi has expressed dissatisfaction with modern Cartesian epistemological thought and its implied philosophy of science. In his book *Personal Knowledge* he says: "Objectivism has totally falsified our conception of truth, by exalting what we can know and prove, while covering up with ambiguous utterances all that we know and *cannot* prove, even though the latter knowledge underlies, and must ultimately set its seal to, all that we *can* prove."[4] In his later book *The Tacit Dimension* he says: "The declared aim of modern science is to establish a strictly detached, objective knowledge. Any falling short of this ideal is accepted only as temporary imperfection, which we must aim at eliminating. But suppose that tacit thought forms an indispensible part of all knowing, then the ideal of eliminating all personal elements of knowledge would, in effect, aim at the destruction of all knowledge. The ideal of exact science would turn out to be fundamentally misleading and possibly a source of devastating fallacies."[5] These statements by Polanyi summarize as precisely as possible the central thesis of all his writings—the fact that no knowledge can be wholly explicit or totally objective as the positivistic philosophy of science has led us to believe. Over and over again Polanyi takes issue with the positivistic perspective and stresses the absence of strict criteria in formulating all knowledge by postulating the existence of a pervasive substructure for all intelligent behavior that he calls the unformulated, tacit dimension of knowledge. He arrives at this structure of knowing by analyzing the nature of scientific discovery. In this paper I intend to set forth the basic epistemological position of Polanyi, and then proceed to outline what I believe is his perspective on the relationship between science and religion.

The Epistemology of Michael Polanyi

Polanyi says that in all acts of knowing three coefficients are involved. There is a person (*A*), who integrates subsidiary clues (*B*), in order to focus on a coherent meaning (*C*). This is the fundamental structure of what he calls the tacit triad or the tacit dimension of knowing. The clues used in this tacit triad may be of two types—subliminal and marginal. Subliminal clues cannot be experienced in themselves or observed directly by the perceiver. They are deeply hidden inside the body. For example, I am unable to observe directly the contraction of my eye muscles or the movement inside the intricate passage-

ways of an organ such as the ear. On the other hand, there are marginal clues that I am able to observe directly. They are normally seen from the corner of a person's eye in observing an object, or they exist at the back of a person's mind as the result of past experiences. These marginal clues provide a stable background for the perception of movable objects. Both of these types of clues are not attended to directly but only in a subsidiary way.[6]

To illustrate this triad, Polanyi uses the example of a person pointing his finger at a wall and exclaiming, "Look at that!" Immediately all eyes look at the finger and follow its pointing to the wall. There is a difference here between the way I am aware of or am attending to the pointing finger and the way I am aware of or am attending to its object, the wall. I am not directly looking at the finger but at the finger pointing to the wall. The finger functions as a subsidiary, proximal, or instrumental clue (*B*) that points to the wall which is the focal or distal object of attention (*C*). I, *A*, establish an integrated relationship between them by recognizing the direction toward which the finger points me. The relationship between *B* and *C* that *A* establishes through an integration is seen to be directive.[7]

Two types of awareness are present here and are involved in the process of knowing: a subsidiary awareness of particular clues (*B*) and a focal awareness of integrated clues that form a coherent whole (*C*). Since the subsidiary or tacit root of knowing is directed from my own self to the focal object, knowledge for Polanyi is seen to consist in a from-to relation, an outward displacement involving both a personal pole and an impersonal one. All knowledge is implicitly the groping of someone and in this regard is personal. The impersonal aspect is the reality that I am searching for and am attempting to discover or contact. These two types of awareness correspond to two types of knowing—knowledge by attending to a focus and knowledge by relying on subsidiaries.

There are many other examples Polanyi offers of these two types of knowing. He lists the following:[8]

FROM SUBSIDIARIES	BY INTEGRATING THEM	WE FOCUS AT
finger	pointing at	an object
features	forming	a physiognomy
motions	combined to	skilled action
probe	exploring	a cavity
sensory clues	combined to	a percept
factual clues	combined to	a discovery
name	designating	a person
stereo pictures	viewed as	a stereo image

In all these examples he is concerned with illustrating the point that

the human phenomenon of knowing is more than what I am able to articulate and perform in an explicit manner. He stresses five indeterminacies toward which his account of tacit knowing points: (1) the indeterminacy of empirical knowledge in its bearing on reality; (2) the unspecifiability of rules for establishing true, as distinct from illusory, coherence; (3) the indeterminacy of the grounds on which knowledge is held to be true; (4) the unspecifiability of the process of tacit integration by which knowledge is achieved; and (5) the unspecifiability of the existential changes involved in modifying the grounds of scientific judgment.[9] He summarizes this perspective by saying we can know more than we can tell.[10]

The process by which a person is said to understand the relation between two events, both of which are known but only one of which can be told, and the principal mechanism by which knowledge is tacitly acquired is called "subception." This process is described in the following experimental example: "Lazarus and McClearly in 1949 . . . presented a person with a large number of nonsense syllables, and after showing certain of the syllables, they administered an electric shock. Presently the person showed symptoms of anticipating the shock at the sight of 'shock syllables'; yet, on questioning, he could not identify them. He had come to know when to expect a shock, but he could not tell what made him expect it. He had acquired a knowledge similar to that which we have when we know a person by signs which we cannot tell."[11] Scientific hunches are based in part on this process of subception or on knowing more than we can tell. As previously stated, some clues are directly observable and identifiable in themselves (marginal clues) and others are not (subliminal clues). This linking of subception to subliminal stimuli or subliminal processes inside our body extends the scope of tacit knowing to include traces in the nervous system and points to the bodily roots of all thought. This point lays the foundation for and is expanded upon by Polanyi in speaking of knowing by indwelling. I will return to this point shortly.[12]

Polanyi further clarifies what he means by tacit knowing by emphasizing that we should not identify subsidiary awareness with the subconscious or preconscious or the fringe of consciousness described by William James. Tacit clues may be difficult to identify or may even be unspecifiable (subliminal clues), but this does not change a subsidiary state into an unconscious one. It is the function of an item that makes it subsidiary. The inferences drawn from these subsidiary clues are not explicit but are tacit inferences.[13] The process of subception is in reality accomplished through this tacit inference. In addition to this functional aspect of tacit knowing, Polanyi speaks

of the phenomenal, semantic, and ontological aspects of tacit knowing. I will use his example of stereoscopic pictures to illustrate this point.[14]

The two views that I am aware of when I see a set of stereoscopic pictures outside a viewer become subsidiary when I put the pictures into a viewer. They are fused into a focal whole. This is the functional relation of the subsidiary to the focal target—what Polanyi has previously described as the from-to relation. The change of appearance that has resulted in a novel sensory experience is known as the "phenomenal" transformation. Further, the combined image of the two pictures is their joint meaning or the "semantic" aspect of from-to knowing. Finally, there is present the "ontological" aspect of something real that exists beyond myself. The subsidiaries move me beyond myself to a focal reference that I believe to be real—the two pictures united as one mirroring some aspect of reality.[15]

In all that we do in interacting with and in knowing the world, we use our body as our ultimate instrument. All of the examples presented in this paper thus far are based on a meaningful integration of our body and of the sensations felt by our body. We rely on our body in a subsidiary manner to attend to things outside it. When a blind man uses a walking stick to find his way around or when we use a tool or a probe, the mechanism becomes an extension of our body. We attend from these instruments to their focal purpose just as we ordinarily attend from our body to things outside our body. It is by interiorizing or pouring ourselves into or dwelling in these objects as subsidiaries directed toward a focal purpose that we make them mean something to ourselves. To make anything function in a subsidiary manner is to interiorize it. Indwelling then underlies all observation and points to the bodily roots of all knowledge.[16]

Visual perception is for Polanyi an important example of the process of tacit knowing and the displacement of meaning, for he sees it to be a from-to knowledge of bodily responses to a beam of light. The beam of light comes from an external object and enters my eyes. My eyes, the muscles adjusting my eyes, those that sustain the position of my head, messages from my inner ear, a massive complex of previous neural adaptations or memories, etc., respond to the beam. A major part of the particulars shaping the sight of an external object seem to be internal actions and stimuli which we cannot feel in themselves. These responses function as subsidiaries which, because of the from-to structure involved in knowing, are projected from the interior of the body and transposed into space outside the body. This projection is a mirroring of the tacit structure of knowing.[17]

Polanyi last of all discusses the dynamics involved in the process of tacit knowing—the dynamics that helps us bridge the gap between our present situation and our ultimate intention. The two powers or moves involved in this discovery process are the intuition and the questing imagination. The questing imagination is the deliberate thought of things not present. It attempts to make us produce ideas, directs our attention to a target that is not yet well supported by subsidiaries, evokes from available resources the implementation of our purposes, and is a focal act. As it goes into action it becomes more intense and concrete. The intuition detects a hidden coherence, guides our imagination toward a possible solution, and integrates what the imagination has hit upon. It works on a subsidiary level and is a spontaneous movement which brings discovery. Neither the clues which it uses nor the principles by which it integrates them are fully identifiable.

Polanyi sees a paradigm for the creative act as described above in the inanimate realm. In this realm we can see nature controlled by different forces which draw matter toward stabler configurations. Quantum mechanics has especially set forth the conception of uncaused causes subject only to control by a field of probabilities. These inanimate processes are characterized by three points: (1) forces drive toward stabler potentialities; (2) catalysts or accidental releasers of friction-locked forces cause them to actualize these potentialities; (3) such accidents may be uncaused events, subject only to probable tendencies. This process can broadly be described as the actualization of potentialities. Human thought and human choice function in a way similar to quantum-mechanical events in that they are uncaused and guided by a field that leaves them largely indeterminate. Discoveries, though, differ from inanimate events in three ways: (1) the field evoking and guiding discoveries is not that of a more stable configuration but of a problem; (2) discovery is not spontaneous but is due to an effort toward the actualization of certain hidden potentialities; (3) the uncaused action which evokes discoveries is usually an imaginative thrust toward discovering these potentialities.[18] Polanyi says in summarizing the dynamics of tacit knowing: "The honors of creativity are due then in one part to the imagination, which imposes on the intuition a feasible task and, in the other part, to the intuition which rises to this task and reveals the discovery that the quest was due to bring forth. Intuition informs the imagination which, in turn, releases the power of the intuition."[19]

In summary of this epistemological perspective, Polanyi says that the human person possesses two types of awareness—subsidiary and focal. These two types of awareness form the basic structure of all knowing—

the from-to structure. When I know something I integrate proximal, subsidiary clues into a distal, coherent whole. This process of integrating or problem solving takes place through the dynamics of intuition and imagination. This knowlege that I have come to believe in possesses two poles—a personal pole in that it is I groping for a solution, and a universal pole in that I am groping for and attempting to contact a reality that to me is at this time hidden.

Science and Religion

I have now reached the point where I believe I can make some statements on the relationship between science and religion based on the perspective of Polanyi's epistemology. The first concerns the fact that the way a person goes about knowing something is the same in all perception and on all levels of knowlege—this person dwells within subsidiary clues to form a focal integration.[20] Science is not concerned with facts and religion with values. Both are seen to involve at their most basic level a faith commitment—a commitment of myself to the belief that I can fill in the gap between my present situation and my ultimate intention by making a new contact with reality.[21] This fundamental act of commitment is what makes the unity of knowledge possible.

All articulate statements, whether religious or scientific, are seen as belief or confessional statements. In order not to be purely subjective they must possess that aspect that Polanyi refers to as universal intent—that is, anyone dwelling within my framework and looking at what I am viewing will be able to see what I see. This aspect moves me to a third point I would like to emphasize—the heuristic aspect of both science and religion. The unfolding and elaboration of neither science nor theology is to be viewed as the logical elaboration of a fixed content. The basic orientation of knowlege is to explore new territory through the use of one's imaginative faculties. Stated in another way, the pursuit of all knowledge uses the experience of our senses as clues that transcend this experience by embracing through the interaction of intuition and imagination a vision of reality beyond the impression of our senses, a vision which speaks for itself in guiding us to a deeper understanding of reality and is open to the adherence of others.[22]

There are other similarities that can be spoken of—the professional structure of both the scientific and religious communities, the structure of authority within both these communities, and so forth.[23] I would now like to go on and sketch out how one might begin to speak of the difference between science and religion from Polanyi's perspective.

I think Polanyi in his earlier writings gave us an insight into the solution of this problem when he spoke about the criteria a scientist uses in trying to establish whether the work he or she is doing is of interest or value to the scientific community. These are: (1) accuracy or reliability; (2) systematic interest or relevance (how this new insight enters into the systematic structure of science); (3) intrinsic interest of the subject matter.[24] The proportion in which these factors enter into scientific judgments of value varies greatly over the many different domains of science. An example of this variance is seen in Polanyi's comparison of physics and biology: "The inanimate things studied by physics are much less interesting than the living beings which are the subject of biology. But physics makes up by its great accuracy and wide theoretical scope for the dullness of its subject, while biology compensates for its lack of accuracy and theoretical beauty by its exciting matter."[25] The way Polanyi goes on to distinguish between the realm of the natural sciences and other dimensions of our cultural system is by means of this variance and, more specifically, the interpersonal appeal that something has for us. There are parts of the universe that are more intrinsically interesting (criterion three), demand more personal involvement, and a greater indwelling on our part in an effort to understand them. Harry Prosch says: "We must dwell more fully . . . in our religion than we do in our psychology, in order to see its meaning, more fully in our psychology than in our biology, more fully in our biology than in our physics, and more fully in our physics than in our mathematics. Yet this does not mean that religion is 'truer' than mathematics, only that its meanings involve more of ourselves in them and thus may be more intrinsically interesting—or overwhelming, anyway."[26] The universe then for Polanyi is seen to be a structured hierarchy of related disciplines characterized by increasing complexity and profundity and demanding more of the personal participation of the knower in the knowing process. This position seems to me to be a logical outgrowth of Polanyi's position that all knowledge is personal but subject matter is of varying intrinsic interest.

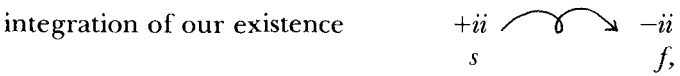
Much of Polanyi's recent but unpublished writings go on to elaborate this difference between science and religion in terms of the types of integration involved in these two areas. I will attempt to summarize some of his most recent material on this matter.

His basic starting point is the tacit triad—in all acts of knowing a person (*A*) integrates subsidiary clues (*B*) to focus on a coherent meaning (*C*). Integrations, though, may be of two kinds—self-centered and self-giving.[27] Self-centered integrations have one common characteristic—what is known focally is more intrinsically inter-

esting than the subsidiary clues involved, which are only meaningful in that they bear on a focus. Acts of discovery of a mathematical formula, moods, the stars are all varied examples of this type of integration. He diagrams these integrations in the following manner:

where $-ii$ indicates lack of intrinsic interest; $+ii$, presence of intrinsic interest; *s*, subsidiary; and *f*, focal. These self-centered integrations are indicative relations—that is, one work or sign indicates something on which it has a bearing. This integration affirms the existence of a definite state of affairs and conveys a factual communication.

In contrast to these self-centered integrations, Polanyi speaks of integrations that are performed through an act of self-giving. The examples he uses are the unfurling of a flag or the sight of a tomb of a life-long friend. In both these cases all our memories, hopes, and fears enter into an integration of which the flag or tomb is a partner. The intrinsic importance of the elements involved is reversed in this act:



where $+ii$ indicates our memories, etc. (presence of intrinsic interest); $-ii$, flag or tomb (no intrinsic interest in itself); and  , how integration starts from *s* and moves to *f* but picks up relevant parts of ourselves and focuses them on flag or tomb. This diagram is essentially the inverse of indication—it is a diagram of what happens in all varieties of symbolism. By uniting our memories and recollection with the symbols we become something more than what we are. In this act we are in some way moved or carried away and grant acceptance to this emotional experience. In regard to the flag or symbol Polanyi says: "The striking fact is that the whole range of life-long recollections, diffusely remembered by the members of a nation, is condensed and infused into a canvas attached to a rod and bearing a conventional pattern. The immensely extended hardly recallable life of a person is condensed into an emotional force attached to an otherwise trivial, meaningless object."[28] This integration does not convey information or affirm an observable or definite state of affairs, but as I mentioned above, moves us toward an emotional acceptance.

Polanyi then goes on to discuss the self-giving structure of rituals,

metaphors, poetry, drama, representative painting, morality, and religion. A ritual is illustrated in the following manner:

The difference between a ritual and a symbol is to be found in the fact that a ritual is an action that has some intrinsic interest in itself and which resembles that which it symbolizes—for example, baptism is a washing.[29]

I will skip over metaphors and poetry and set forth his perspective on drama since it clearly introduces another aspect that has not been mentioned up to now, though it has been implicit in the above discussion—the integration of incompatible elements.

The actor on a stage is trying to simulate something while also keeping this simulation short of deception. Hamlet simulates the killing of Polonius and also being killed by Laertes. This simulation is kept from being deceptive by an opposing force intrinsic to drama. This opposing force is the apparatus of stagecraft. The power of drama is to be found in this fact—it is an integration of incompatible elements that moves us and carries us away. Polanyi says: "Art appears to consist, for painting and for drama, in representing a subject within an artificial framework that contradicts its representative aspects. . . . "[30] In summarizing his perspective on poems, drama, and paintings and the power they exercise over us Polanyi says: "By means of its artificial framework, which is sharply incompatible with its subject, a work of art takes us into an experience beyond the realm of nature and practical affairs, and our understanding and acceptance of art consists in letting it thus carry us into its own transnatural domain. Art does not inform us about its subject, but makes us live in it, as its maker first lived in it—sometimes many centuries before."[31]

It is along the line of self-giving integrations that Polanyi approaches the interpretation of religion. Religion for him is seen to exist at the end of a long line of evermore complex integrations. It concerns the meaning of the whole of existence. It differs from science not because of the methodologies used in approaching the disciplines, but because the feelings evoked by a work of art, a poem, and ultimately religion are much more existential than intellectual. Polanyi illustrates this point by referring to Johannes Kepler who wrote in 1619: "So now since eighteen months ago the dawn, three months ago the proper light of day, and indeed a very few days ago the pure Sun itself of the most marvellous contemplation has

shown forth—nothing holds me, I will indulge my sacred fury; I will taunt mankind with the candid confession that I have stolen the golden vases of the Egyptians, in order to build of them a tabernacle to my God, far indeed from the bounds of Egypt."[32] These emotions experienced by Kepler in his discovery are not transmitted to the student who studies his work today. Rather, Polanyi says, one learns about "the proportionality of cubes and squares in the planetary system without being deeply moved by these matters."[33] The triumphant experience of Kepler remains mainly his own. This is not true when we are carried away by a great poem or play or work of art. Throughout the integration of our own existence into a great work of art we somehow enter and become part of the original experience of the creator and are deeply moved. These things "make us revise our estimate of the human race."[34] They do not convey factual information, or truth or falsehood as a mathematical formula can do, but rather transfuse our experience "into a matter unprecedented in nature or the affairs of men."[35] The great power of religion lies in its capacity for integrating large, seemingly incoherent experiences in brief actions of ritual and symbols. Polanyi says: "What science says about its own subject is, for the most part true and interesting. But it does not give us an image of the world in which our position as responsible creative beings can be understood."[36] This latter task is the function of our higher realms of culture and ultimately of religion.

Some Concluding Reflections

I believe Polanyi's approach to the problem of science and religion constitutes a major breakthrough in this area of thought, for it purifies both science and religion of their dogmatism, fundamentalism, and literalism. Personally, it offers me a picture of the universe I can commit myself to and accept. I would like briefly to elaborate this perspective that Polanyi sets forth and that I have fundamentally accepted as offering me a framework within which I can understand the situation I am in and the universe around me.

I am born into a particular form of existence, a historical setting, that is impersonally given and not of my deliberate choosing. In this sense I am a creature of circumstance. But I accept my form of existence and my circumstance as my particular problem, as the situation within which I can concretely exercise my personal judgment in arriving at deliberately responsible decisions. This acceptance of my particular situation circumscribes my calling.

This acceptance is furthermore a personal commitment that places me within a transcendent perspective—a perspective understood as

involving my deliberately chosen participation in a situation impersonally given. That is, I have chosen to accept the limits of the historically given setting into which I was born and have grown up. I also further hope that through my contact with the universal aspirations of other persons I will be able to perform an obligation that upon initial reflection appears impossible to achieve. This personal acceptance, contact with universal aspirations, and feeling of impossibility set forth the paradox of human dedication.

As mentioned above, this personal commitment is a commitment to my particular problem of existence as well as the universal aspirations of others. It is always a commitment to a set of values that can never be made totally explicit or that can never be totally exhausted or achieved. It is a commitment to a reality intimating new dimensions and directions open to my further discovery and exploration that may dissent from the teachings which fostered them. The paradox of human dedication sets forth a framework within which I am urged to pursue a set of values that will never be fully achieved.

This vision of a person's calling, of his acceptance and commitment to it, and of his relationship to reality places him within a framework of potentialities. Here we see humanity immersed in potential thought. Humanity, the present result of millions of years of cosmic evolution and emergence, is freed from the absurdity of the determinist's vision and faced with the possibility of creative originality within the area circumscribed by its original personal acceptance of an impersonal situation. The following selection from Polanyi summarizes this perspective well: "It is the image of humanity immersed in potential thought that I find revealing for the problems of our day. It rids us of the absurdity of absolute self-determination, yet offers each of us the chance of creative originality, within the fragmentary area which circumscribes our calling. It provides us with the metaphysical grounds and the organizing principle of a Society of Explorers."[37]

NOTES

1. Michael Polanyi, "Science and Reality," *British Journal for the Philosophy of Science* 18 (1967): 187, 191.

2. Michael Polanyi, *Knowing and Being* (London: Routledge & Kegan Paul, 1969), p. ix (cf. *Daedalus* [Spring 1973]). The title of the *Daedalus* issue is "The Search for Knowledge." Many of the articles discuss the destructive effects the natural science model has had in different disciplines.

3. Michael Polanyi, "Why Did We Destroy Europe?" *Studium Generale* 23 (1970): 909–16; cf. Alfred North Whitehead, *Science and the Modern World* (New York: Free Press, 1967).

4. Michael Polanyi, *Personal Knowledge: Towards a Post-Critical Philosophy* (New York: Harper Torchbooks, 1958), p. 286.
5. Michael Polanyi, *The Tacit Dimension* (New York: Doubleday & Co., 1966), p. 20.
6. *Knowing and Being* (n. 2 above), pp. 112–15, 139–40; cf. *Tacit Dimension,* p. 31.
7. All of Polanyi's writings speak of the structure of tacit knowing. The following sections are specifically devoted to it: *Personal Knowledge,* pt. 2; *Knowing and Being,* pt. 3; *Tacit Dimension,* chap. 1.
8. Michael Polanyi, "The Structure of Tacit Knowing" (lecture, University of Chicago, May 1969), p. 2a.
9. *Knowing and Being,* p. 120; "The Creative Imagination," *Chemical and Engineering News,* April 25, 1966, pp. 88, 92; "Logic and Psychology," *American Psychologist* (January 1968), pp. 27–43.
10. *Tacit Dimension,* p. 4.
11. Ibid., pp. 7–8, for other examples.
12. Ibid., p. 14; *Knowing and Being,* pp. 142–43, 167.
13. *Knowing and Being,* pp. 138–58, 194, 212; "Logic and Psychology" (n. 9 above), pp. 31, 39.
14. *Knowing and Being,* p. 212; "Logic and Psychology," pp. 29–30.
15. *Tacit Dimension,* pp. 9–13; "Logic and Psychology," p. 29.
16. *Knowing and Being,* pp. 183–85; "Logic and Psychology," pp. 33–34; *Tacit Dimension,* pp. 15–18.
17. *Knowing and Being,* pp. 79, 115, 126, 129; "Logic and Psychology," pp. 38–40; *Tacit Dimension,* pp. 13–15.
18. *Tacit Dimension,* pp. 88–89; "Unpublished Transcript of Conversation between Michael Polanyi and Raymond Wilken," pt. 2, p. 20.
19. "The Creative Imagination" (n. 9 above), p. 91.
20. Michael Polanyi, *The Study of Man* (Chicago: University of Chicago Press, 1959), p. 96.
21. "Science and Reality" (n. 1 above), p. 195.
22. *Personal Knowledge,* chap. 1.
23. See the following for more work along these lines: Richard Gelwick, "Theology as a Heuristic Enterprise" (lecture, Consortium for Higher Education Religion Studies, Dayton, Ohio, 1971); William T. Scott, "A Bridge from Science to Religion Based on Polanyi's Theory of Knowledge," *Zygon* 5 (1970): 41–62.
24. *Knowing and Being,* pp. 54, 82–83; *Personal Knowledge,* pp. 135–36.
25. *Knowing and Being,* p. 54.
26. Harry Prosch, "Cooling the Modern Mind: Polanyi's Mission," *Skidmore College Bulletin* (August 1971), p. 18; cf. *Personal Knowledge,* pp. 279–86; *Study of Man,* pp. 71–99.
27. Michael Polanyi, "Meaning" (lecture, University of Texas, Austin, 1971), pp. 3–4 ff.
28. Michael Polanyi, "Acceptance of Religion" (lecture suppl. no. 4, University of Chicago, May 1969), pp. 6–7.
29. "Meaning," pp. 4–5.
30. Michael Polanyi, "What Is a Painting?" *American Scholar* 39 (1970): 664.
31. Ibid., p. 665.
32. *Personal Knowledge,* p. 7.
33. "What Is a Painting?" p. 666.
34. "Acceptance of Religion" (n. 28 above), p. 8.
35. "What Is a Painting?" p. 666.
36. "Acceptance of Religion," p. 11.
37. *Tacit Dimension,* p. 91.