THE ROOTS OF TACIT KNOWLEDGE: INTUITIVE AND PERSONAL JUDGMENT IN POLANYI'S EARLY WRITINGS (1939-1946)

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ABSTRACT

Polanyi says that the concept of tacit knowledge is "necessarily fraught with the roots that it embodies" (TD, xviii). This paper demonstrates that these roots can be seen in Polanyi's early writings between 1939 and 1946. In particular, the concepts of "intuitive judgment" and "personal judgment" have some peculiar features that flow subsequently into the idea of tacit knowledge. In this regard, they can be considered ancestors of Polanyi's best-known concept. In the present paper, I propose a historical reconstruction of the two concepts. In particular, I focus on the problems from which they stem, namely Polanyi's criticism of research planning and his account on the functioning of science and its institutional and social arrangement. Besides this historical reconstruction, I draw a comparison between the concept of tacit knowledge and its early predecessors.

The Autonomy of Science and the Planning of Science

After having retired in the mid-thirties from the professional pursuit of science in the field of physical chemistry, Polanyi began to take an interest in social sciences and economics. The concerns raised by the revolutionary events in the USSR and the spread of USSR-like ideas in the United Kingdom were two of the main reasons for this transition (see Nye 2011, 183-222 and Scott and Molesky 2005, 171:210).[1] More particularly, economic planning and the planning of scientific research were the most compelling problems for Polanyi because they were considered as a severe threat to a free society (Polanyi 1941). Although the two problems are tightly related, I shall only focus on the latter.

Polanyi argues that science can flourish and produce its valuable results only if it is autonomous. If so, each attempt to put science under a heteronymous rule cannot but lead to a frustration of scientific research. Consequently, since the planning of science is precisely an attempt to lead scientific research externally, it necessarily frustrates the scientific pursuit, and it can potentially lead to its clumsy distortion or even to its destruction.

Basically, the autonomy of science consists of its being governed by an efficient mechanism of "scientific opinion" (Polanyi 1943, 143). The main task of scientific opinion is to impose scientific standards to which scientists have to conform so that their results could be accepted. These standards affect research in several ways. First of all, scientific opinion determines what counts as science in each particular branch at a given time. By doing so, consequently, it provides a set of previous discoveries on which new ones have to be based. Moreover, scientific opinion can either encourage those lines of research considered particularly promising or discourage other lines. In this way, scientific opinion determines standards of scientific interest. However, this is not the only kind of standard determined by scientific opinion. The criteria of reliability and precision, the traditional methods of science, and the particular procedures of each branch are defined by scientific opinion as well (Polanyi 1941, 437 and 1943, 24-5). That is the reason why each scientist needs to submit her new discovery, based on thousands of previous discoveries, to the judgments of her colleagues in order to gain acceptance.[2] The ruling of scientific opinion is, of course, mostly informal. Nevertheless, it is also partially formal, for example, in the system of peer review (Polanyi 1943, 23-25). In conclusion, the main functions of scientific opinion are in general "to preserve and disseminate in approved form the past achievements and accepted principles of their special field; to stimulate new individual contributions and to judge their value: discussing, and either rejecting or accepting new additions to the body of the heritage under [its] care" (Polanyi 1941, 441).

The planning of science is an attempt to replace the authority of scientific opinion with political control of science. In this perspective, science is no longer the disinterested search for truth; rather, it becomes a means by which political power can improve the condition of the people, addressing the right direction of scientific advance so that science can fulfill its duty to the community. Consequently, scientific research is no longer an end in itself, but it is instrumental in the advancement of the good of society and the satisfaction of its needs.[3]

Planned Order and Dynamic Order

Polanyi's main argument against this conception is based on the idea that science is "an organism of ideas" (Polanyi 1939, 180), or a "dynamic order" (Polanyi 1941, 437).[4] He points out that we can observe, both in nature and in society, two different kinds of order, i.e., "one resulting from the exercise of authority *over* a group, the other from the enjoyment of freedom by the individuals *in* a group" (Polanyi 1941, 431). Although an in-depth analysis of this distinction between "planned order" and "dynamic order" is beyond the scope of this article, we can provide two useful examples: a marching troop is an instance of "planned order", while the order we can observe in a crystal is an example of "dynamic order". The two kinds of order exhibit a substantial difference. Indeed, while the marching troop behaves according to a prearranged plan, the order displayed by a crystal is the result of "spontaneous mutual adjustment" (Polanyi 1941, 432) of the constitutive particles of the crystal. Thus, the main point of the distinction is that a planned order is achieved by limiting the range of action of the components because, in principle, soldiers could go in every direction, but they must go straight, synchronizing their steps. In contrast, a dynamic or spontaneous order is the result of free interactions of the elements of the ordered whole, since the order of a crystal is accomplished by the internal forces acting between a group of particles. Moreover, it is crucial to stress that whenever an order generates spontaneously, any attempt to recreate it through an external agency or a plan is ineffective, and the opposite holds as well. The examples proposed above clearly support this claim.

Since science is a kind of order and its basic units are the individual scientists, then it is easy to demonstrate that science is a spontaneous order and not a planned one. In fact, the relationship between each scientist and the system of scientific opinion is a kind of mutual adjustment. Indeed, the activity of individual scientists continuously modifies scientific opinion and the general understanding of science as whole because they make new discoveries, spread new methods, find new interests, etc. Thus, any attempt to plan science cannot reproduce the great achievements that science reached in the last centuries, because these were the result of free interactions between scientists. Consequently, Polanyi concludes that the growth and dissemination of science is the result of dynamic order, and this is the reason why it cannot be planned.

Three Stages of the Growth of Science

So far, we have only focused on the institutional arrangement of science, i.e., the system of scientific opinion. However, this is only a third of Polanyi's exposition. Indeed, according to Polanyi, the forces contributing to the growth and dissemination of science operate in three stages (Polanyi 1943). The mechanism of scientific opinion that controls each scientist by imposing the standards of science is only the second stage. The third one is the decision of the public whether or not to accept scientific theories as to the real explanation of a given phenomenon through public discussion. Nevertheless, the crucial stage for us is the first, when "the individual scientists take the initiative in choosing their problems and conducting their investigations" (Polanyi 1943, 29). Indeed, in his reflection about this first stage, Polanyi stresses the role played by "intuitive judgment", i.e., the ability to embark on original lines of inquiry, to guess the right direction of its development and eventually to find the solution of the problem. Intuitive judgment would appear to foreshadow the concept of tacit knowledge.

Intuitive judgment

One of the main functions of intuitive judgment is "to discover the opportunities in the given state of science" (Polanyi 1943, 20). Exploiting their own intuitive judgment, scientists can identify the most promising lines of research. In this case, the first stage contributing to the growth of science is not distinguished clearly from the others. Instead, they are tightly connected. Indeed, when at the first stage individual investigators embark on a particular line of inquiry, they do not exercise their own personal wishes because "at any particular moment the next possibilities of discovery in science are few" (Polanyi 1943, 21). On the contrary, they cannot but exploit the opportunities provided by the current state of their own branches. Consequently, scientists' personal wishes are deeply constrained. In particular, since what counts as science in a given time is determined by scientific opinion, the opportunities of new discoveries available at any time are sketched precisely by scientific opinion. Thus, scientific opinion constraints scientists' exercise of intuitive judgment. The main point is that scientists do not exercise their intuitive judgment in a vacuum, but in the given context of the current state of their branch of science. Even though embarking on original lines of inquiry seems to be paradoxical because it seems to amount to guessing something hidden according to personal wishes, the task is nonetheless definite enough because the current state of the subject defines a range of possible impending discoveries.

The exploitation of the possibilities provided by the current state of science relies on intuitive judgment as well. In this regard, it is worth quoting Polanyi at length:

> Scientific research is not less creative and not less independent, because at any particular time only a few discoveries are possible. We do not think less of the genius of Columbus because there was only one New World on this planet for him to discover. Though the task is definite enough, the solution is none the less intuitive. It is essential to start in science with the right guess about the direction of further progress…All the time the scientist is constantly collecting, developing and revising a set of half-conscious surmises, an assortment of private clues, which are his confidential guides to the mastery of his subject (Polanyi 1943, 22).

Here, Polanyi briefly describes the process leading from the knowledge of a scientific problem to its solution and so to a possible discovery. From the beginning of this process, intuitive judgment plays a crucial role. Not only does it enable scientists to choose the right problem among the few opportunities disclosed at a given time, also it provides the best strategy for attacking the problem. In both cases, the use of intuitive judgment is not equal to the exercise of personal wishes. Indeed, when the scientist seeks the solution of the problem, she has to apply the traditional methods of science and adopt its standard of reliability and precision (Polanyi 1941, 441). However, within this framework, her ability to collect, develop and revise that "set of half-conscious surmises" still remains the determining factor leading to discovery. As Polanyi states:

> There is in him [the scientist] a hidden key capable of opening a hidden lock. There is only one force which can reveal both key and lock and bring the two together: the creative urge which is inherent in the faculties of man and which guides them instinctively to the opportunities for their manifestation…all the essential decisions leading to discovery remain personal and intuitive (Polanyi 1943, 22-23).

Thus, the state of knowledge and the existing standards of science define both the range within which the scientist must find her problem and the methods she can employ to seek its solution. Nevertheless, the decisive steps still are a matter of intuition, creativity, instinct, and personal commitment. As we shall see in the next section, the analysis proposed by Polanyi in the article "The Autonomy of Science" anticipates the considerations on the scientist's ability to pursue research and make a new discovery relying on tacit knowledge.

Before developing this comparative theme, it is important to point out another interesting trait of intuitive judgment: it consists of a "loose system of intuitions [that] cannot be formulated in definite terms" (Polanyi 1943, 22). Unfortunately, Polanyi does not analyze this claim in-depth. He only says that since this system of intuitions cannot be formulated, it can only be transmitted through practice.[5] This is a crucial point. Indeed, saying that it cannot be formulated implies that we cannot provide a set of definite rules for replacing the use of intuitive judgment (assuming the rules as a kind of exact formulation of something). Thus, only through personal collaboration with people skilled in the use of intuitive judgment, the apprentice can learn to employ her own intuitive judgment. Therefore, since intuitive judgment is crucial in the process leading to new discoveries, we can conclude that we cannot formulate rules for making discoveries. Even though Polanyi does not formulate this conclusion explicitly, this insight is remarkable because he comes to it in 1943, a long time before he develops a full theory of scientific discovery and tacit knowledge.

Intuitive Judgment and Tacit Knowledge

This early reflection about intuitive judgment reveals in advance some features of tacit knowledge. In this section, I briefly compare what Polanyi says about "intuitive judgment" to his later account of tacit knowledge. As I shall show, its reflection in the early forties has some analogies to his analysis of problem-solving and the role played by tacit knowledge in problem-solving. Indeed, recognizing a good scientific problem and solving it employing intuitive judgment is just a particular case of a more general ability to know and solve a problem using tacit knowledge.

In *TD*, Polanyi exhibits the knowledge of a problem as a paradigmatic case of tacit knowledge.[6] He begins by pointing out that the preliminary step for solving a problem is, of course, the recognition of a situation as problematic. Even though this is a platitude, Polanyi notices that it raises a paradox proposed initially by Plato. As Polanyi states:

> It is a commonplace that all research must start from a problem…we take it for granted, without noticing the clash of self-contradiction entailed in it. Yet Plato has pointed out this contradiction in the *Meno*. He says that to search for the solution of a problem is an absurdity; for either you know what you are looking for, and then there is no problem; or you do not know what you are looking for, and then you cannot expect to find anything (*TD*, 21-22).

According to Polanyi, Meno's paradox raises a serious issue. Indeed, although we generally recognize and solve problems, the paradox prevents us from explaining how this advance in knowledge is possible. However, this contradiction arises only because of some assumptions about the nature of the knowledge and the knower. In particular, Meno's paradox rests on three assumptions. The first one concerns the epistemic status of the agent: she can either completely know or completely not know. The second one concerns the nature of knowledge: each instance of knowledge is a piece of information separated from any others. The third one concerns the meaning of learning: learning is just the transfer and the acquisition of these pieces of knowledge. These assumptions establish a mechanistic (or in Polanyian terms, an "objectivist") conception of knowledge, according to which all knowledge is always explicit. As Polanyi states: "the *Meno* shows conclusively that if all knowledge is explicit, i.e., capable of being clearly stated, then we cannot know a problem or look for its solution" (*TD*, 22). Indeed, if all knowledge were explicit, we could not know a problem because a problem is something hidden, still undiscovered and thus we cannot have explicit knowledge of it. Nevertheless, everyday experience, scientific and not, shows that in effect we know problems. Consequently, the objectivist conception of knowledge is wrong.

Polanyi's solution, or dissolution, of the paradox, rests on the complete rejection of this conception of knowledge. Indeed, the fact that "to see a problem is to see something that is hidden" or that "it is to have an intimation of the coherence of hitherto not comprehended particulars" (*TD*, 20) is paradoxical only in this perspective. However, if we refuse this conception, then we can account for the fact that we know problems, surmising "the presence of something hidden" (Polanyi 1967, 188). Indeed, as Polanyi's states, "this would of course be nonsensical, if we had to know explicitly what was yet undiscovered. But it makes sense if we admit that we can have a tacit foreknowledge of yet undiscovered things." (*TD*, 23). Consequently, we can account for the recognition of a problem only if we reject the idea that all knowledge is explicit and accept that the knowledge of a problem is an instance of tacit knowledge. As Polanyi concludes: "the *Meno* shows, therefore, that if problems nevertheless exist, and discoveries can be made by solving them, we can know things, and important things, that we cannot tell." (*TD*, 22).

Tacit knowledge also explains how we can find a solution to a problem. Although both the discovery and the solution are unknown, tacit knowledge enables us to find the solution to a problem, as intuitive judgment leads the scientist in all the essential steps towards the discovery. A complete analysis of Polanyi's reflection about problem-solving is beyond the scope of this article (for more, see *PK*, 135-136). However, what we are told is enough for establishing Polanyi's conclusion: "Tacit knowing is shown to account (1) for a valid knowledge of a problem, (2) for the scientist's capacity to pursue it, guided by his sense of approaching its solution…." (*TD*, 24).

Of course, Polanyi's later account of the role of tacit knowledge in the process of problem-solving is much more developed than his early considerations about intuitive judgment in scientific discovery. However, the aim of this comparison is not to anachronistically claim that in 1943 Polanyi had already elaborated his concept of tacit knowledge. Rather, this comparison aims to show some links between Polanyi's idea in 1943 and his better-known ideas about tacit knowledge. Indeed, these links support the conclusion that Polanyi gained his basics insights about tacit knowledge while dealing with the problems displayed in the previous section. The value of these remarks, thus, lies in making clear that Polanyi didn't develop the concept of tacit knowledge to simply clarify the maxim "we can know more than we can tell".

Personal Judgment

In the following years, Polanyi developed further his insights about the "tacitness" of some kind of knowledge. In *SFS*, in particular, he elaborates the concept of "personal judgment", which is a development of the "intuitive judgment" and a more elaborated draft of the concept of tacit knowledge. In the following section, I propose an analysis of this concept.

Polanyi's Criticism of Positivism

Polanyi's reflection about personal judgment could not be separated from his criticism of "positivism". Since I analyze in-depth Polanyi's criticism of positivism in a forthcoming paper, here I just sum up the burden of this criticism to provide the context within which the concept of personal judgment is developed. Polanyi describes the positivist account of science as an attempt to base science only on radical empiricism and skeptical doubt. In this perspective, the essence of scientific objectivity would lie in establishing rigorous mathematical relations between measured variables employing fixed rules (Polanyi 1950, 2). Indeed, only in this way could science satisfy the requirement of both empiricism and skepticism. Polanyi's criticism, on the contrary, aims to show that science cannot rely just on these two principles because scientific practice exceeds the mere application of rules. Indeed, each rule has to be interpreted, but any further rule cannot determine the very interpretation. Thus, rules have indeterminate content, and so they cannot provide unambiguous prescriptions for scientific discovery, verification, and falsification. For this reason, we need to find another factor on which these scientific processes are based. To provide an alternative account of scientific discovery, as well as of verification and falsification, Polanyi resorts to the concept of "personal judgment".

Scientific Discovery and Personal Judgment

To overcome the positivist view, according to which scientific discovery can be reduced to the mathematical articulation of observations and measurements through fixed rules, Polanyi sets an example aiming at showing how we can make a discovery in everyday life. "Suppose we wake up at night to the sound of a noise as of rummaging in a neighbouring unoccupied room. Is it the wind? A burglar? A rat?... We try to guess. Was that a foot-fall? That means a burglar! Convinced, we pluck up courage, rise, and proceed to verify our assumption." (Polanyi 1946a, 8-9).

According to Polanyi, the ordinary case of a sound attracting our attention may reveal aspects of scientific discovery that are concealed in the positivist view. In particular, Polanyi focuses mainly on the way the research starts, then is conducted, and eventually, the "theory of the burglar" discovered:

> Curious noises are noticed; speculations about wind, rats, burglars, follow, and finally one more clue being noticed and taken to be decisive, the burglar theory is established. We see here a consistent effort at guessing and at guessing right. The process starts with the very moment when, certain impressions being felt to be unusual and suggestive, a 'problem' is presenting itself to the mind; it continues with the collection of clues with an eye to a definite line of solving the problem; and it culminates in the guess of a definite solution. (*SFS,* 8).

We find here all the chief moments leading to discovery. The first step is, of course, the recognition of a given situation as problematic, an issue that we already dealt with in the previous section. In *SFS*, Polanyi restates that a scientist's guesswork relies, at its first step, on her "largely undisclosed abilities", and that each further attempt to guess right must be based "on a sufficient foreknowledge of the whole solution" combined with "an intimation of approaching nearer towards a solution" (*SFS*, 18). As an artist, the scientist is "guided by a fundamental vision of the final whole", a vision necessarily not explicit because it "can be definitely conceived only in terms of its yet undiscovered particular" (*SFS*, 18). The idea that the knowledge of a problem is non-explicit, not rule-based knowledge is already outlined in the forties. No rules can determine if a given situation is or not a problem, or if it is or not of scientific interest.

The "theory of the burglar" allows disclosing a further point concerning the discovery, namely that a dialectic between observations and speculations characterizes it. Against the overestimation of observations supported by positivism, Polanyi argues that "the part of observation is to supply clues for the apprehension of reality" (*SFS*, 15). In the proposed example, finding a problem (i.e., a noise in a neighboring unoccupied room) is followed by speculations about wind, rats, or burglars. A further observation, i.e., hearing a footfall, provides a decisive clue, leaning the speculations towards the hypothesis of a burglar, a real burglar. According to Polanyi, this is precisely the kind of interplay between speculation and observation that we can point out in scientific discovery (see *SFS*, 16).

Polanyi's account completely reverses the positivist story about the relationship between observations and theory. Since scientific propositions are like statements about the presence of a burglar in the next room, then these propositions cannot be derived directly from data because observational data as such do not arrange themselves mechanically in a definite manner, which determines an unambiguous theory. The presence of a rat or a burglar, or the effect of wind, all equally explain the noise. As Polanyi states: "The theory of the burglar—which represents our discovery—does not involve any definite relation of observational data from which further new observations can be definitely predicted. It is consistent with an infinite number of possible future observations" (*SFS*, 9). Moreover, we can point out that observations as such are no longer the starting point of the research. Instead, it is an evaluation of a given fact as something problematic which sets the tone of scientific research. Actually, this point is not clear from the example of the theory of the burglar. However, we notice that noises as such don't turn automatically on speculations. Indeed, it is easy to find cases when those kind of noises are not detected at all. Thus, it is precisely the evaluation of the noise as something problematic that pushes toward speculations about the origin of that noise. Of course, this evaluation of the observations is quite different from the observations as such.

The reassessment of the role of observation involves another positivist commonplace, that is, the idea that research is all about indiscriminately gathering new observations. Polanyi demonstrates that this is not the case. When the problem is stated, its solution is not a matter of collecting and organizing further observations, but instead treating specific observations as clues fitting a solution. If that is correct, the process by which scientific propositions come into existence excludes "the possibility of deriving these by definite operations applied to primary observations" (*SFS*, 11-12). Indeed, strictly speaking, observations are never "primary", because they are never considered as such, and so they cannot be directly manipulated through rules and procedures. On the contrary, observations need to be treated as "clues for something", namely clues for reality, or at least for something believed to be the reality before they can play any part in the research. For these reasons, Polanyi argues that "the process of their [of scientific propositions] discovery must involve an intuitive perception of the real structure of natural phenomena", precisely because it is this intuition which allows seeing given observations not as such but as clues for something real.

This last point makes clear that the interplay between speculation and observation is not arbitrary, but subject to some constraints. Indeed, speculations about what observations stand for (or are clues of) are bound exactly by our intuitions about what reality is. Since "science is assuming something real whenever its propositions resemble the theory of the burglar" (*SFS*, 9), the intuitive perception of the real structure of natural phenomena sets the boundaries of speculations. Polanyi defines these intuitions as "premises of science", and refers to them also as "the fundamental guesses of science concerning the nature of things" (*SFS*, 15).

What is Reality?

We cannot go into detail about Polanyi's reflection on what reality is. However, we need to focus on some essential points to make Polanyi's considerations on scientific discovery intelligible. As far as his reflection in the forties is concerned, I could provide a simple definition saying that reality is that which possesses a coherent outline. Polanyi develops this idea starting from "the process by which we usually establish the reality of certain things around us" (*SFS*, 10). For instance, Polanyi says, we can see a ball or an egg at a glance because we can perceive their coherent shapes against a background and consequently determine that they are a real ball and a real egg. According to Polanyi, we can extend this reasoning from the perceptive cases to cognitive ones (*SFS*, 10). Following this parallelism, which is a fundamental insight in Polanyi's thought, we can look at scientific discovery as a process of aggregation and integration of data and observations in a coherent form. Indeed, scientific propositions are concerned with reality exactly because reality is defined as what possesses a coherent outline. The difference between the perceptive integration of the impressions in a coherent shape (e.g., seeing an object, listening to a melody), and the integration involved in scientific discoveries is only a matter of degree: "We can say, therefore, that the capacity of scientists to guess the presence of shapes as tokens of reality differs from the capacity of our ordinary perception, only by the fact that it can integrate shapes presented to it in terms which the perception of ordinary people cannot readily handle" (*SFS*, 10).

Looking at the scientific discovery from the perspective of recognition of form, extending the Gestalt theory of perception provides a further reason to reject the positivist idea for which it is the outcome of an operative process. On the contrary, Polanyi argues, scientific discovery is rather the result of a process of emergence, in which observations are continually integrated according to the rules of the art of scientific practice in order to realize a more and more coherent outline:

> We may follow up our parallel between discovery and Gestalt perception by regarding the process of discovery as a spontaneous coalescence of the elements which must combine to its achievement. Potential discovery may be thought to attract the mind which will reveal it—inflaming the scientist with creative desire and imparting to him a foreknowledge of itself; guiding him from clue to clue and from surmise to surmise. The testing hand, the straining eye, the ransacked brain, may be thought to be all labouring under the common spell of a potential discovery striving to emerge into actuality. The conditions in which discovery usually occurs and the general way of its happening certainly show it in fact to be a process of emergence rather than a feat of operative action (Polanyi 1946a, 19).

The Integrative Function of Personal Judgment

Understanding scientific discovery as a process of emergence, characterized by an interplay between speculation and observation that enables us to make contact with a part of reality, finally allows us to point out the role played by personal judgment. Since "the propositions of science thus appear to be in the nature of guesses" (*SFS*, 17), scientists are supposed to evaluate evidence according to their personal judgment at each step towards discovery. Since this evaluation involves an intuition about the real structure of natural phenomena, it cannot be fulfilled by any formulated precept, but is the outcome of a delicate and personal art. This guesswork, however, is not unfounded. As we already showed in the first section, the individual scientist's research is constrained under various respects by the authority of scientific opinion. In this section, moreover, we touched on the fact that scientist accepted the premise of science as a broader framework within which she develops her research. While the rigorous fulfillment of any set of critical rules would completely paralyze discovery and the unconstrained intuitive speculation would lead to extravagant conclusions, personal judgment transcends both creative impulse and critical caution, allowing us to realize a successful integration of observations in a coherent shape. Although Polanyi does not here describe in depth this integrative process, he foreshadows the basic operation of tacit knowledge, namely the integration of proximal particulars into a distal whole. Indeed, we can "translate" Polanyi's account of scientific discovery in *SFS,* employing the categories developed subsequently. For example, we should say that scientists move from particular observations to discovery, or that they are subsidiarily aware of observations as clues to reality and are focally aware of discovery as an expression of a natural order. Thus, this non-explicit ability firstly spotted in scientists' activity serves as a model for a broader account of knowledge developed by Polanyi from *Personal Knowledge* onward. Polanyi himself prefigures this extension saying that the same process leading to discovery can be found in other mental efforts; for example, the recovery of a lost recollection, the solution of riddles, the invention of practical devices, the recognition of indistinct shapes, the diagnosis of an illness, the identification of a rare species, and also the prayerful search for God (*SFS*, 20).

Conclusions

This analysis has shown how some essential characteristics of the concept of tacit knowledge can be found in the writings of the period 1939-1946 in response to problems that are not strictly epistemological. Indeed, both the idea that intuitive judgment enables scientists to recognize and solve problems and the idea that personal judgment integrates scattered particulars in a coherent form are analogous to the not explicit and not rule-based nature of tacit knowledge. At the same time, however, these intuitions do not stem from a clarification of the maxim "we can know more than we can tell", but rather from a criticism of the planning of science and an alternative account of scientific discovery.

As shown in the first section, Polanyi elaborates his criticism of planned science by sketching an explanation in three stages of the growth and functioning of science, although I only touched on the second and the third one. I focused extensively on the first stage, in which scientists rely on "intuitive judgment" to identify problems and solve them. In that context, I pointed out how intuitive judgment anticipates some characteristics of the concept of tacit knowledge, in particular the role of tacit knowledge in problem solving and scientific discovery. Eventually, we examined the concept of "personal judgment", which lays the groundwork for Polanyi's alternative account of knowledge. Indeed, personal judgment anticipates the idea that knowing is a non-explicit activity by which we integrate many scattered particulars into a coherent form.

Although I did not consider them, many other aspects of Polanyi's reflection are already outlined in this period, besides the ones concerning tacit knowledge. Among them, the concept of reality, the continuity between perception and cognition, the fiduciary foundation of assertion, the personal participation of the knower in the known. A diachronic and historical approach to these concepts, as the one here proposed, would be significant for a better understanding of Polanyi's ideas.

ENDNOTES

[1]The discussion about scientific standards will be proposed again and further developed in *Personal Knowledge*, in particular in chapter 6 dealing with "Intellectual passions" (*PK*, 140-215).

[2]In this regard, according to Polanyi, scientists act both as a judge and as a businessman. When they rely on previous discoveries, "they resemble a judge referring to a precedent". When they make a new discovery and try to gain acceptance by other scientists, they act like a businessman "first seeking the most profitable application of his resources and then soliciting the consumers' approval for his goods" (Polanyi 1941, 437).

[3]See Polanyi (1939, 186-189; 1941, 428; 1943, 19; and 1945, 2-3) for an extensive reconstruction of this doctrine, mainly based on J.D. Bernal's book "Social function of science".

[4]Organicistic metaphors recur in the writings of this period and the idea of "dynamic order" too has an organicistic flavour if we stress the fact that the embryonic development (Polanyi 1941, 432) is proposed as an order of this kind. Elsewhere, after having described the process of growth of science, Polanyi concludes, "We have here an organic process before us which is in many ways comparable to the growth of a living being. The branches of science appear, as it were bent on increasing their body through incorporation of new materials which they find suitable for assimilation; and these efforts, like the processes of growth in a living being, are rigorously dominated by a characteristic vital context; which, while retaining its essential identity, keeps developing further every time another parcel of new material is added to the body under its control" (Polanyi 1944, 3).

[5]Strictly speaking, these intuitions cannot be transmitted at all. Polanyi himself recognises that its transmission, even through practice, is "very imperfect" (Polanyi 1943, 22). As Polanyi makes clear in later writings, there is not any "content" passing from the master to the apprentice in the process of teaching and learning. The transmission of knowledge is rather a process of intelligent and creative imitation stemming from conviviality, in which the learner picks up this knowledge while he watches the master and emulates his effort. See also *PK*, 55, 206, and 219.

[6]See also *PK*, 126-131 for a deeper analysis on problem-solving.

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