DEVELOPING A PHILOSOPHY OF TECHNOLOGY

R. J. BROWNHILL

(formerly:)University of Surrey, UK
Haslemere, Surrey, England
e-mail: bob52brownhill@btinternet.com

ABSTRACT

Michael Polanyi argued that pure science was concerned with furthering knowledge but that applied science was tied to the market place. He divided science into pure science, technically justified science, and systematic technology; pure science was concerned with transcendental values but applied sciene with utility. We show that this distinction breaks down as utility and the market place can be fitted into Polanyi's wider concept of the just society. His concept of tacit knowledge also gives us an insight into how practical knowledge is developed and passed on. His theory provides us with a comprehensive view not only of pure science but the whole gamut of the development of thought.

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Introduction

Applied science or technology has taken second place to pure science in the main stream of our cultural heritage. This attitude towards applied science was apparently continued in the work of Michael Polanyi when he argued that pure science was concerned with furthering knowledge whereas applied science was tied to the market place. (Polanyi 1946) However, it is clear that Polanyi looked at pure science in a very special way as he conceived of the pure scientist's task as being far more than just an attempt to further knowledge but an attempt to grasp and reveal ultimate reality: a reality that is not immediately accessible to our senses for it is external to us, and is partly hidden from us (Polanyi 1965). He argued:

> "To say that the discovery of objective truth in science consists in the apprehension of a rationality which commands our respect and arouses our contemplative admiration: that such discovery while using the experience of our senses as clues transcends this experience by embracing a vision which speaks for itself in guiding us to an even deeper understanding of reality – such an account of scientific procedure would be generally shrugged aside as outdated Platonism: a piece of mysterymongering unworthy of an enlightened age. Yet it is precisely on this conception of objectivity that I wish to insist in" (Polanyi 1958: 5-6).

We cannot therefore entirely rely on our normal senses to apprehend this reality but have to rely on the tacit co-efficient of knowledge (Polanyi 1964), our intuitive faculties,

to draw back the veil and reveal this reality. Polanyi was rejecting the then orthodox Kantian concept of the task of pure science as an attempt to gain an increasing knowledge of appearances. The Polanyian scientist was concerned with gaining an increasing knowledge of appearances, but his major task was to go beyond this and grasp an understanding of reality as it really was, In Kantian terminology he was attempting to gain a knowledge of things-in-themselves. Kant had tried to show that this was not possible as all our knowledge had to originate in the experience of our senses, and things-in-themselves were beyond sense. Knowledge, therefore, necessarily had to be a knowledge of appearances[1] . The Kantian argument pointed out that if a knowledge of things-in-themselves was to be obtained, it could only be obtained by intellectual intuitions but this was impossible as our intuitive capacity was confined to our senses. A pure scientist could not gain a knowledge of things-in-themselves but only an increasing knowledge of appearances.

By rejecting Kant's view of intuition Polanyi was in a position to argue that the pure scientist was able to gain a knowledge beyond sense. Science began to appear as an attempt to understand ultimate reality, and therefore the tasks of the metaphysician and theologian inherently similar to that of the pure scientist (Brownhill 1968). This rejection of the Kantian position also challenged the argument of Polanyi's contemporary philosopher of science, Karl Popper, who had attempted to build a barrier between metaphysics and science by his criteria of falsifiability (Popper 1959) , and his insistance that a scientific theory must be testable.

The Popperian stance pointed to a problem with Polanyi's argument, for if the pure scientist was concerned with gaining knowledge of ultimate reality and things-in-themselves then how could we know whether the claim was knowledge at all or mere belief? In other words how could we test the claim? Polanyi's writings provide two answers to this question: the first is revealed in his discussion of personal knowledge and its comparison with subjective belief, and the second is given in his discussion about the nature of the scientific community. However, neither answer gives us absolute certainty, and in this way points to the continued openendedness of science.

Polanyi criticised the idea of pure objectivity and argued that when we observe phenomenon we would have a concept about it and that this concept would be personal to ourselves, although it might be similar to other peoples concepts. Pure objectivity postulates an impersonal observer who can obtain impersonal knowledge but Polanyi denied this, and argued that we approach phenomena through a framework of commitments which by its nature denied the possibility of an impersonal observer and therefore an impersonal justification of knowledge. In fact, rather than impersonal knowledge he saw that there were only two possible alternatives: subjective belief, and personal knowledge. He distinguished between the two in the following way, and stated:

[1] This is Kant's position in the Critique of Pure Reason.

> It is enough to establish once more the principle which distinguishes them namely that commitment is a personal choice, seeking and eventually accepting, something believed (both by the person incurring the commitment and the writer describibg it) to be impersonally given, while the subjective is altogether in the nature of a condition to which the person in question is subject (Polanyi 1958: 302).

Actually, for Polanyi, the subjective appeared to be even less than this, as it was a passing whim, a piece of information one is not bothered about, an opinion as opposed to a belief, and an opinion that one certainly would not defend to the last ditch. On the otherhand personal knowledge is a belief that one is absolutely committed to and because of this claims universal validity for it. In fact, one is passionately committed to it, one believes heart and soul that it it is true. Polanyi stated that, "...the personal and universal mutually require each other" (Polanyi 1958: 306). He went on to argue that he denied the traditional epistemological aim to define the truth and falsify in impersonal terms, as these alone could be accepted as truly universal. He stated, "The framework of commitment leaves no scope for such an endeavour, for its acceptance necessarily invalidates any impersonal justification of knowledge" (Polanyi 1958: 303) .

His second answer was that we could test or rather judge a person's understanding of supra sensibilia by the committed beliefs of other members of the scientific community. In this way we could provide some confirmation but neither verify or falsify a discovering scientist's knowledge claim. In other words the personal knowledge of the discovering scientist could be judged against the personal knowledge of other members of the scientic community. In this way the scientific community made decisions under the control of its own members, their interpersonal knowledge.

Polanyi's view has been rejected by a number of philosophers of science, notably Popper and Lakatos, and Popper's former pupil, Musgrave (1969), who take up a Kantian stance, and by the Marxist, J. D. Bernal (1936) who believed that science was concerned with utility, and some economists (See Carter and Williams (1956), Carter and Williams (1959)). A interesting criticism comes from the liberal/ consevavative thinker Michael Oakeshott who in fact was very sympathetic to Polanyi's idea of tacit knowledge and his ideas on the passing on of knowledge. Oakeshott was concerned with the nature of science, and rejected the belief that science was concerned with giving a knowledge of ultimate reality, and also the notion that a veil had to be drawn back to reveal a hidden and external reality. Pure science, he argued, was an attempt to bring stability to our perceptions, but in order to do this it must leave our perceptions behind. He stated:

> Science may be said to begin only when the world of perceptible things has been left on one side, only when observations in terms of personal perception have been superceeded ... Scientific knowledge is not 'organised common sense' it is a world of knowledge

> which begins to exist only when common sense and its postulates have been forgotten or rejected. Experience becomes scientific experience when it is a world of absolutely communicable experience. Scientific experience is based upon a rejection of merely human testimony; its masterconception is stability (Oakeshott 1933: 169-170).

Oakeshott then argued that the scientist achieved this absolutely communicable and stable experience by considering nature under the category of quantity. He argued:

> Nature, matter or what is experienced in science are nothing other than the world considered under the category of quantity, because the method of science is incapable of elucidating any other world, and the method of science is restricted to this way because the world sought is a world satisfactory to the purpose of scientific experience, a world of ideas before all else common and communicable (Oakeshott 1933: 90).

However, both Oakeshott and Polanyi recognised that the task of the scientist was to expand the systematic ideas of pure science, and believed that the quantative could lead to the qualitative. It is these two concepts which brought these two thinkers together, as both considered that the major aim of pure science was to further knowledge, and that any attempt to introduce the aim of utility into pure science would bring about its destruction. The conversations of the community of pure scientists must not be interrupted by utility. In a way both these views are neo-Kantian but Polanyi's view is far more traditional as it recognised the Pythagorean tradition (See Polanyi 1958: 5-6; Brownhill 1969), and re-introduced metaphysics as a respectable occupation. The new metaphysician appeared under the guise of the pure scientist, and was concerned with attempting to reveal ultimate reality, or the Kantian things-in-themselves, and the scientific grail of testability was thrown out of the window. Whereas, it could in a sense, appear possible to test our knowledge of appearances, our knowledge of things-in-themselves appeared remote and suspect. For the individual scientist and the community of scientists the possibility of certainty in science had to be reduced to a confirmation based on a commitment to a belief. In effect, the old theological doctrine of St, Augustine credo ut intelligam, I believe so that I can understand, reappeared as a doctrine of scientific method.

2. Polanyi's Distinction Between Pure Science, Technically Justified Science and Systematic Technology

Polanyi divided science up into pure science, technically justified science, and systematic technology (Polanyi 1958: ch 6). He argued that there was not a profound difference between them in the logical development of pure and applied science as

both are concerned with development of systematic ideas. However, they differ in the following respects, pure science is concerned with revealing ultimate reality, technically justified science is concerned with that part of pure science which can bring great utilitarian benefits, e.g., the study of coal, but has little relevance to the main body of pure science, systematic technology is the study of technology that has developed its own systematic ideas, e.g., electrotechnics and the theory of aerodynamic can be cultivated in the same way as pure science, although it remains attached to the economic motive, and practical utility. It can be seen that for Polanyi applied science consists of technically justified science, and systematic technology, and that these differ from pure science by the fact that the main reason for their pursuit is utility, whereas pure science is pursued in order to apprehend ultimate reality. Nevertheless, Polanyi argued that technically justified science and systematic technology should be organised in the same way as pure science. In pure science he believed that a spontaneously co-ordinated system free from outside interference and run by scientists themselves should, and does, undertake the organisation of pure science, and that systematic technology and technically justified science should be organised in the same way. He concluded that although technology was not pure science, but that all systematic technology that goes under the name of science must be organised in the same way. He declared that "Systematic thought being of the essence of science, the progress of sciences must be guided by the system of science" (Polanyi 1946).

Of course, Polanyi's economics and his very notion of political freedom emphasised the failure of central planning by the state, and therefore a need to avoid state interference. (Brownhill 1966) However, the technologist is governed by practical purposes if his work is to be of any use, although he may hold on to the traditional scientific belief in achieving the truth. His discovery will not be tested by his own conscience and its obligation to the truth but by whether or not his discovery or theory is seen to work. His work must have practical use or it is irrelevant. The Marxist, J. D. Bernal, insisted that a scientist was concerned with revealing the truth but that this could not be used to make a distinction between pure and applied science. He stated:

> In another sense the ideal of pure science was a form of snobbery, a sign of the scientist aping the don and the gentleman. An applied scientist needs appear somewhat of a tradesman, he risks losing his amateur status. By insisting on science for its own sake the pure scientist repudiated the sordid material foundation on which the work is based (Bernal 1936: 69).

He went on to argue that the idea of pure science being concerned only with the truth reduced it to a position like cross-word puzzles (Bernal 1936: 97), a game that could in reality give no satisfaction for life work, and that for such satisfaction "men require that what they do has special importance as well ... whatever the scientists

themselves may think there is no economic system which is willing to pay scientists just to amuse themselves" (Bernal 1936: 97).

If the structure, the development and the nature of pure and applied science are the same as both are attempting to increase our knowledge of appearances, we are entitled to wonder how a distinction within the neo-Kantian tradition can be made between them. Both are furthering knowledge, and both are attempting to understand reality under the category of quantity in order to bring stability to our perceptions. In fact a distinction cannot be within this tradition. As both applied and pure science study appearances there can be no difference in their intrinsic value. It does not seem possible to do this on rational grounds, as no reasonable critera can be found to do so but such a distinction can be made on emotional grounds. We can then include applied science within the neo-Kantian tradition as the applied scientist is attempting to give us a greater knowledge of appearances. Certainly the applied scientist does this but does he do more than this? He is trying to give us a greater knowledge of appearances for the purpose of controlling our environment, whereas Polanyi argued that the pure scientist tried to gain a knowledge of appearances for its own sake. This was the argument that the pure scientist pursued his research for its intrinsic worth, whereas the applied scientist pursued it for its extrinsic worth. Within the neo-Kantian view there is no distinction of this sort, so a distinction has to be looked in their joint tasks. The applied scientist undertakes the same task as the pure scientist as one of his tasks is understanding appearances but then has the other task of applying this knowledge. However, a distinction cannot always be made as an applied scientist, although expanding knowledge with the intention that it will be of use may not actually apply the knowledge himself. This is why the term 'fundamental research' is often used to refer to the development of the ideas of pure and applied research, and the term applied science is used to refer to the application of these ideas to solve specific problems. This is a tacit recognition that there is a difficulty in distinguishing between pure research and much of modern applied research, for instance, in the field of electronics. The old distinction between formulating ideas and the application of them has to be expressed in a different form. The line has to be redrawn below areas that would have previously been considered the domain of practical application. Perhaps it could be drawn on the basis of a scientist's intention but it is difficult to see how this could be so as there is apparently no particular reason why a scientist should pursue his research for the sake of knowledge or with the hope that the knowledge will eventually be useful, and one intention can change to the other as a scientist becomes obsessed with his work.

The great value of science is that it has enabled us to gain a greater control over our environment, and this value itself is derived from the fact that it has enabled us to have a greater stability in our existence. It has enabled us to consolidate our present level of material well being. This in its turn has enabled to have the leisure to pursue speculative activities. Simon Rottenburg (1966) has argued that we could conceive of pure science as a leisure activity that we are better able to pursue as

our leisure increased. In other words that as we move rapidly away from a subsistence level economy we are more able to provide for purely speculative activities.

It was Polanyi's claim that pure science was concerned with revealing the truth about ultimate reality that provided the obvious distinction between himself and his critics. Yet his argument for freedom in science did not rely on this metaphysical stance. It relied on the argument that a free science, spontaneously organised by scientists themselves provided the most efficient form of organisation, and would provide greater economic and utilitarian benefit than any other (Polanyi 1963). I argue that it is the task of metaphysics to lay the ground for science. Metaphysics lays the ground for a further apprehension of reality, and the task of the scientist is to further stabilise this extremely uncertain knowledge. Popper argued that in fact metaphysics no longer lays the ground for science (Popper 1959: 277-8) and science has had to increasingly lay the ground for itself. Philosophy in recent years has forsaken its own metaphysical task and become a hand maiden to science attempting to clarify our knowledge of appearances.

We can conceive of science as a stabilising factor in our understanding of reality. It is attempting to make more certain and concrete the speculations of metaphysics and traditional philosophy. In this sense it becomes allied to technology which is an attempt to stabilise to even a greater extent our theoretical knowledge to make it practical. We can say that it is of the same nature but of a different level. It is all an attempt to master reality: to make us lords and possessors of nature as Descartes argued. The ideal function of technology is to stabilise the theories of science, but again as in the case of metaphysics, science has not provided enough theories to allow technology to pursue its task effectively. Technology has had to leave its original function as a practical craft to become a science itself in order to provide enough theories of the right type. It is no longer parasitic on science but has necessarily become part of science, as science was originally part of metaphysics.

In order to give more strength to this concept of our understanding of this concept of our understanding and eventually mastery of reality with first technology merging into science, and then science, the study of appearances, merging into speculations about things-in-themselves we have to deny the Kantian division between the world of phenomena and noumena, or rather look at it in a different way. In this sense we are conceiving of things-in-themselves as a world of unformulated possibilities, possibilities that may become actual. We can conceive of them as similar to a prime number after *n*, a number that may eventually be known. Of course, it could be argued that by doing this we are in practice denying that the existence of the noumenal world as we are stating that it can become the phenomenal world. In other words the existence of the noumenal world is a heuristic device to further our knowledge of appearances. This seems acceptable as long as we realise that under this concept of the noumenal world made up of unformulated possibilia that may become possibilia, possibilia exist that may become part of the world of appearances but need not necessarily do so. This leads to the argument that that

the so called noumenal world is made up of at least two levels: unformulated possibilia and formulated possibilia that become part of our knowledge of appearances. The task of the metaphysician related to science would be to formulate possibilia, and the task of the scientist to try and confirm that the possibilia were part of appearances. Karl Popper by his theory of falsifiability provided an attempt to do this but ultimately failed. However, Polanyi recognised that in practice it had to be the scientist himself who had to operate as a metaphysician, partly because metaphysicians had abdicated their task but also because the extremely complicated and technical nature of the speculations required prevented a non-scientifically trained philosopher from particularising his speculations enough to satisfy the needs of a scientist.

Ideally scientific knowledge, if it is to be completely stable knowledge of appearances should meet the tests of some methodological norms. In practice as both Polanyi and Thomas Kuhn (1964) pointed out our theories do not have to meet a strict test but merely have to fit into the prevalent beliefs of the scientific community to be accepted as part of scientific knowledge. In such a sense scientific knowledge always remains noumenal knowledge in the sense I have formulated it. It is possibilia and could never be absolutely verified or falsified only confirmed.

Interestingly Popper's distinction created by his theory of falsifiability was not between scientific knowledge and non scientific knowledge, but between statements that could be tested, and those which could not. If a theory was falsified conclusively it could not become part of science. In fact Popper argued that if we attempted to define science as a body of conclusively tested knowledge then science could not exist. He stated, "Every scientific statement must remain tentative for ever" (Popper 1959: 280). His distinction was between possibila and non possibilia. His attempted division between what he called metaphysics and science (Popper 1959) could not work, as it was and is apparently an arbitrary statement. Why should it be the case that the negation of an existential statement is a scientific statement but an existential statement is not? It of course could not be claimed that the non existential statement was meaningful whereas the existential statement was not as this would not be logical. However, it is not the case that metaphysics is made up of meaningful but untestable statements, and by negating them they suddenly become scientific statements, For instance, In theology you do have negatve existential statements: the via negative.[2] Popper's mistake was to take on board Kant's two world theory but

[2] See Richard Rolle in his Incendium Amoris "Thou askest what God is? I answer shortly to thee: such a one and so great is He that none other or ever may of like or so mickle. If thou wilt know properly to speak of what God is. I say thou shalt never find an answer to this question. I have not known, angels know not, archangels haven not heard. Wherefore how wouldst thou know what is unknown and also untaught." Metaphysics and theology` have included negative statements about G od without making positive statements. It is possible to state what God is not but not what he is. Rolle's approach is an example of the via negative of Pseudo-Dionysius, the negative pathway of understanding ultimate reality.

for us the noumenal world is just a world of possibilia and the possibilia move to their realisation as appearances as they are confirmed and stabilised. Popper's thery of falsificaction was useful within his system as it appeared to offer a test but it would greatly widen the scope of science if we accepted all negated statements as scientific, and as we have already seen it is impossible to provide a test which is certain. We are left then with the Polanyi/Kuhn solution that science is what the scientific community is prepared to accept. This solution is not arbitrary as it is based on the reasonable test of estimating a theory's validity by comparing it with theories that have already been accepted and the judgment of practising scientists.

3. Values, Tacit Knowledge, and a Method of Discovery

Michael Polanyi was a liberal philosopher, a philosopher of the free society, but the philosophy had within it a strong conservative element. This conservative element had two basic characteristics: a belief in the progress of knowledge under the control of tradition, through the interpersonal knowledge which was held in a community, and an educational theory based on learning by experience. By interpersonal knowledge we mean that each community would possess a body of shared beliefs, and that as a community they would judge innovations by reference to such beliefs. Indeed such a body of shared beliefs had to exist before we could designate a group as a community. All communities concerned with scholarship would have a systematic body of shared beliefs, and much of Polanyi's analysis was designed to show that the scientific community was no different to other communities in that it progressed in the same way, under the control of interpersonal judgments. He also claimed that communities not concerned with scholarship would progress in the same way. It was the case that they would not possess such a systematic body of ideas but they would possess a body of coherent beliefs (Polanyi 1951: 46) , and that these beliefs would keep a check on innovations.

He set out the values which he thought an ideal society would possess, and stated:

> The ideal of a free society is in the first place to be a good society; a body of men who respect truth, desire justice and love their fellows. It is only because these aspirations coincide with the claims of our own conscience, that the institutions which secure their pursuit are recognized by us as the safeguards of our freedom (Polanyi 1951: 29-30).

The free society becomes the just and moral society where excesses in individual initiative are controlled by the operation of the community's conscience through the law and through the process of socialisation. The law is not opposed to men's morality but is derived from it, and acts as a reminder to our conscience to follow our obligations. Polanyi has produced a theory of constitutional freedom with the

proviso that the law and institutions of the body politic should mirror the shared beliefs of the community. It is also the case that the economics and technology within such a society will reflect the shared values of the community as a whole. The transcendental values of justice, truth and freedom.

We are now in a position to examine his theory of learning. His theory is based on his theory of tacit knowledge, "We know more than we can tell." (Polanyi 1966: 4) For example, it may be possible for an expert golfer to describe the swing of the club, the position of one's legs in making a shot, where the ball should be hit but such explicit knowledge cannot create a good golfer. We can only hope that one will improve by watching the expert and by constant practice emulate him. The expert in fact knows far more than he can tell. Polanyi argued that there were constant instances of this type of tacit knowledge which cannot be explicitly stated. For instance, he pointed out that at universities tremendous efforts are made in practical classes in an attempt to teach pupils to identify cases of diseases, and specimens of rocks, of plants and animals. Michael Oakeshott picked up this theme of tacit knowledge and making judgmemts, when writing about teaching and learning and argued that teaching involved two forms of communication: "... teaching may be said to be a twofold activity of communicating 'information' (which I will call instructing) and communicating 'judgment' (which I shall call 'imparting'), and learning may be said to be a twofold activity of acquiring 'information' and coming to possess 'judgment'" (Oakeshott 1967: 170).

Polanyi believed we could develop tacit knowledge by a method akin to the demonstrations of Gestalt psychologists that we could know a physiognomy by integrating our awareness of its particulars without actually being able to identify the particulars. We could use our tacit knowledge "by relying on our awareness of them for attending to the coherent entity to which they contribute." (Polanyi 1964) It was by a process he called 'indwelling' that we began to recognise the necessary clues for understanding something. By indwelling he meant an immersion in the subject matter of our inquiry. We concentrate entirely on our research until it becomes part of ourselves, an extension of ourselves. In this way "... we can know clues of perception by dwelling in them, when we attend to what they jointly indicate, and that we see parts of whole forming a whole by dwelling in the parts. We arrive thus at the conception of indwelling" (Polanyi 1964).

In relating his concept of tacit knowledge to different disciplines he argued that beliefs could only be properly understood, and acknowledged as a form of knowledge, if they existed within a framework of theories and beliefs that were themselves tacitly accepted. If, for instance, one did not accept the same framework of the discovering scientist, then although it may be possible to recognise the rationality of a theory – its coherence, one would not be able to recognise its veridical qualities. He argued that all judgments took place within a particular interpretative framework (Polanyi (1959). Indeed to exist as a scientist we must hold a similar interpretative

framework as our colleagues, This is the basis for Polanyi's use of consensus in the scientific community as his criterion of acceptability of a discovery. They are participating in the same ball game and are able to judge each others discoveries as they have similar interpretative frameworks.

In the process of setting out his concept of tacit knowledge and indwelling he was really also setting out the method or process of discovery. There are five stages in this process:

1. Indwelling is the stage of steeping oneself in all that is; in contacting, the texture, mood, range and content of the experience. The researcher needs to be fully aware of his situation and subject. The researcher becomes immersed and involved with the experience being studied.
2. A period of waiting while the ideas gel. He contemplates the subject as his mind considers the experience. This is the process which allows strategic intuitions and tacit insights to emerge. It is a period of reflection on the material gained. The understanding the researcher has of the experience is not yet complete and remains as a collection of thoughts which have not yet coalesced.
3. The decision is the stage when the disjointed collection of thoughts actually come together. It is the stage which Polanyi called a vision of reality. He moves from speculation to analysis looking for consistency and coherence.
4. Personal knowledge is the stage where the whole process is gone through again,and an estimate made of whether it can be put forward to his colleagues as a correct judgment and decision. The researcher is now committed to it.
5. Presentation is the stage when the process has been completed and the discovery can now be put forward as a universal claim. It is now ready for the estimation by his colleagues through public debate.

The different stages do not provide a template for discovery, as the stages do not explain how to listen to, or utilise, intuition or tacit knowledge. They represent the response of the mature experienced researcher to his study. They provide a rationale for discovery rather than a formula for achieving the truth. The achievement of personal knowledge is really a process of self reflection. It is an understanding of oneself, one's personal commitments. Reality in a sense is constructed by practitioners and is their representation of reality rather than reality itself. Polanyi was actually looking on science as a skill. He always accepted the importance of empirical knowledge but attempted to bring out the importance of looking at science as a skill really understood only by its practitioners. Self reflection and awareness were very much, part of what he emphasied as they were connected to the desire to acheve the truth, and in doing this to continually challenge and check all our speculations. Morality lay at the heart of his theory, and without it his 'Republic of Science' and all his other communities would fall apart. It not only meant honesty in dealing with colleagues but a commitment to contact and reveal the truth as we believed it to be.

4. Conclusuion

We have seen that if Polanyi is correct then there is a method for confirming theories, by indicating their acceptability to the scientific community through a process of spontaneous co-ordination and consensus. Although it is also argued that this sort of confirmation gives no certainty. We also argued that by being accepted as part of scientific knowledge, so called metaphysical knowledge became more stabilised, and appeared more certain. Its position as knowledge is stabilised and if this knowledge can be used for practical purposes, becomes even more stabilised, as it has received greater confirmation. Logically my argument entails that the so called noumenal world is a world of possibilia, and science will always remain a world of possibilia even when it receives a greater confirmation through practical use. Practical use does not by itself demonstrate the truth of theory but can only explain why in prevalent theory an explanation for its success can be made, as time continues a more satisfactory explanation may be given.[3] Nevertheless confirmation for a theory is enhanced when it can be used to control the environmental world.

Metaphysics, science and technology for analytical purposes can be divided but modern day metaphysicians are quite likely to be scientists, and modern scientists at the forefront of scientific development probably need to be metaphysicians, while modern technologists need to be scientists and then in their speculations probably metaphysicians as well. All are involved in the task of comprehending nature for the sake of mastering our environment. The method of conquering our environment has to include a combination of emotion and reason. Polanyi's notion of heuristic passion and commitment is as necessary as his notions of continued criticism and challenge not only by individual scientists but by the scientific community in its public debate, and co-ordination. Emotional commitment to research and its conclusions provides the possibilia, and emotional commitment to their beliefs are the basis for the decision on the acceptability of the discovery by the scientific community. Polanyi's writings provide us not only with a picture of the scientific community in practice but an insight into the process of discovery, and how the traditions and practical skills needed to be an innovative scientist are passed on from generation to generation.*

* An earlier version of this paper was read at the conference Reconsidering Polanyi, Budapest, June 2008.

[3] For instance arguments about global warming.

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