3: THE KNOWING SUBJECT IN PIAGET, POPPER AND POLANYI

3.1 INTRODUCTION

3.1.1 Under the Shadow of Kant

It is common for Anglo-Saxon philosophers to characterise Piaget's position as Kantian (Hamlyn,1971:12,15; Toulmin,1971:54,55; Kitchener, 1980:386). Although this finds support in French philosophers such as Descombes (1980:6) it is an altogether too superficial characterisation of the tradition of French-speaking philosophy in which Piaget worked.

Toulmin's reference (1971:54) to Piaget's philosophical training as Kantian fits only if we classify as Kantian all philosophy outside the mainstream of Anglo-Saxon philosophy that owes anything of substance to Kant. To do this is to adopt a sloppy system of classification that lacks the careful distinctions on which all good philosophy rests.

The dominant influence in Piaget's philosophical training was Léon Brunschvicg, first indirectly through Arnold Reymond at Neuchâtel and later directly at the Sorbonne. Brunschvicg belonged to a stream of philosophy in the French-speaking world that, while influenced by Kant, as has been, in one way or another, virtually all philosophy since Kant, diverged from Kant too decisively to be characterised as either Kantian or neo-Kantian. It is a stream that takes its inspiration from Cournot rather than Comte in furthering the revolution of thought that Kant is regarded as having begun but that was frustrated in its further development by the Kantian conceptual system.

Brunschvicg recognised the importance of the Kantian revolution and also acknowledged Comte's revolutionary role but held that, as with Kant, his conceptual system frustrated the fulfilment of Comte's revolutionary intention. In Cournot he saw the fruitful way to go

forward toward the fulfilment of both the Kantian and Comtean revolutionary purposes which, in the case of Comte in particular remained a largely unfulfilled intention (Brunschvicg,1951-8:Vol.3,57-58,63-65; 1947:164,165). He regarded himself as in "the authentic tradition of intellectualism" represented by Leibniz and Spinoza while he saw in the Kantian and neo-Kantian doctrines of the categories a fatal deviation from that tradition (Brunschvicg,1951-8:Vol.3,86,87). Just how decisively that separates him from a Kantian position should be clear when we recall that what Brunschvicg saw as Kantian deviations from "the authentic tradition of intellectualism" represented by Leibniz and Spinoza Kant saw as making good serious deficiencies in Leibniz and Spinoza (Kant,1928:Part II,45-47; 1933:283-288).

This is by no means to imply that the influence of Kant on Brunschvicg and others in this important stream of French philosophy was negligible. On the contrary, an understanding of Kant is crucial for understanding Brunschvicg. Brunschvicg followed Kantian idealist intellectualism in making the autonomous intellect of the subject formative of knowledge and, in that respect, followed in the Kantian tradition. On the other hand, he rejected entirely the Kantian notion that this subject is equipped with any kind of a priori conceptual structure, proposing instead a dynamic constructive principle as the rational governing principle of cognition. In developing this notion he assigned a mathematical character to this ultimate dynamic governing principle, in contrast to Kant for whom mathematical principles are secondary principles (Kant,1933:195-197). For Brunschvicg, by contrast, it is mathematics that is at the deepest foundations of knowledge providing man with "the true norm of truth" (Brunschvicg,1981: 577).

While, therefore, there is a clear link between Brunschvicg and Kant the break between them is so fundamental that, in my view, it is

entirely unsatisfactory to follow Descombes (1980:6) in labelling Brunschvicg "neo-Kantian". It is, I suggest, more satisfactory to describe his position as a "constructivist idealism"; the idealism indicating the link with Kant while the qualification "constructivist" indicates the decisive divergence from Kant.

If we wish to understand Piaget's thought, particularly at those points where it deviates from the philosophical orthodoxy of the 20th century English-speaking world we will have to view it against the background of Brunschvicg's constructivist idealism and not within a Kantian framework. To recognise Kantian influences in Piaget is legitimate. To classify his position as Kantian is not.

Kant spearheaded a revolution in philosophical thought that has influenced all sub-streams in the mainstream of subsequent philosophical development. Central to that revolution was the severing of epistemological discussion from metaphysical questions; a severance that, in turn, gave epistemology a foundational role in philosophical discussion. Only Kantians and neo-Kantians have attempted to follow the Kantian systematics but all the main streams of epistemological discussion have followed Kant in isolating epistemology from metaphysical discussion. Piaget's pursuit of epistemology as a scientific, rather than philosophical, discipline is simply an attempt to take that revolution to its next and, as Piaget saw it, final stage.

But Kant has influenced subsequent epistemology in more than its isolation from metaphysics. The divergence that is so apparent between Piagetian epistemology and mainstream epistemology in the English-speaking world is not due to the Kantian character of Piagetian epistemology on the one hand - a crude Kantianism as Toulmin would have it (Toulmin,1971:54) - and an epistemology without Kantian influence on the other.

Piagetian epistemology, with its move away from Brunschvicg's idea-

list intellectualism to an abstractive intellectualism with constructivist interaction has moved even further away from Kant, though the ancestry of his epistemology undoubtedly leads in a direct line through Brunschvicg and Cournot to Kant, with traces of positivist influences.

The divergence between the mainstream of epistemology in the 20th century Anglo-Saxon world and the epistemological development in the French-speaking world represented by Cournot, Brunschvicg and Piaget results from the fact that they take their starting points in different features of the Kantian system. Each of them equally rejects the Kantian system - hence neither is Kantian or neo-Kantian - but each embraces a particular feature of that system as the key to its own epistemological development. Because they select very different features their respective epistemologies diverge sharply.

Epistemology in the Anglo-Saxon world embraced wholeheartedly the concept of epistemology expounded by Kant in the CRITIQUE OF PURE REASON as analysis of the conceptual structure of knowledge. This situation is reflected in the almost exclusive citation of this work in references to Kant. It is an approach that is authentically Kantian in that Kant's severance of epistemology depended on the reduction of epistemology to the analysis of the conceptual structure of knowledge, to which the CRITIQUE OF PURE REASON was devoted.

Because Anglo-Saxon epistemology, at least in the 20th century mainstream, abandoned the Kantian idealism, and with it the notion of an innate conceptual structure of the understanding, the nature of the analysis of the conceptual structure of knowledge changed. Cognitive norms were no longer looked for in a universal structure of the subject's thought but in a formal system external to the subject. This effectively shifted epistemological analysis from the analysis of the structure of thought to the analysis of the language of knowledge,

whether the language of everyday discourse or the formalised language of science. All questions about the functioning or processes of thought in the subject were assigned to psychology. In harmony with this development in epistemology, philosophy of science developed as methodological analysis; the formal analysis of the conceptual theoretic structure of science.

While the significance of this divergence from Kantianism should not be underrated, it is a development that remains true to the basic Kantian conception of epistemology as the analysis of the conceptual structure of knowledge.

In contrast to this the movement in French-speaking philosophy represented by Brunschvicg rejected the Kantian conception of epistemology as analysis of the conceptual structure of thought and took its epistemological starting point in the Kantian conception of the active subject as expounded in the CRITIQUE OF JUDGEMENT.

Brunschvicg states this position quite explicitly in a passage in which he argues that the fundamental flaw in the Kantian critique that prevented Kant from fulilling his own intentions is his retention of the Aristotelian and scholastic heritage, transmitted by the Cartesians, that makes concepts prior to judgment. This leads to the "strange parcelling out of the mind in three distinct faculties" that is "the condemnation of Kant's postulate, the confirmation of the thesis that judgment is original (primitive)".

The only way to be true to the spirit of critical philosophy, therefore, is to forsake the letter of Kantianism, abandon the Kantian categories and begin directly with judgment as the "constitutive act of knowledge" and hence the fundamental starting point of epistemology (Brunschvicg,1964:26,27,40).

This leads to the development of epistemology in a way that contrasts sharply with 20th century epistemological development in Anglo-

Saxon philosophy where the emphasis has been on the analysis of knowledge as a conceptual or lingual product. This way of approaching epistemological problems in Anglo-Saxon philosophy is exemplified by Moore (1953), Ayer (1964) and Armstrong (1973) and by the difficulty that both Hamlyn (1971) and Toulmin (1971) have with Piagetian epistemology because it deals with the activity of the subject rather than the analysis of concepts. By contrast the development of French epistemology represented by Brunschvicg's constructivist idealism emphasises the rational processes of thought that are held to secure the validity of knowledge as a product.

On this conception the analysis of the processes of thought is not only permissible but indispensable to epistemology. It is the very heart of the epistemological enterprise. A logical analysis of concepts and language, whatever its subsidiary value may be, does not address the fundamental epistemological question of cognitive normativity since normativity is not identified with the structure of the product but with the activity of the subject that generates the product.

This conception of epistemology as concerned primarily with the analysis of the activity of the subject is the one adopted by Piaget. In so far as it stresses the formative activity of the knowing subject in cognition it is a conception that shows an unmistakably Kantian influence. On the other hand, in rejecting the Kantian notion that cognitive normativity is to be found in the conceptual structure of knowledge it rejected the Kantian conception of the nature of epistemology. For this reason, while the link with Kant is no doubt less direct, the emphasis in Anglo-Saxon epistemology on the analysis of conceptual/lingual structures remains closer to the Kantian conception of *the nature* of epistemology. In neither case, in my view, is the label "Kantian" or "neo-Kantian" warranted yet in each case there are

affinities with Kant.

Those features of Piagetian epistemology that philosophers of the English-speaking world find strange are not due, therefore, to the Kantian character of that epistemology. On the contrary, so far as they relate to the Kantian background at all, they are due to the fact that Piaget, following an important tradition of French-speaking epistemology, rejects the Kantian conception of the nature of epistemology that philosophers in the English-speaking world have retained as a cornerstone of their epistemological assumptions. It is not his adoption of the Kantian notion of the knowing subject as formative of knowledge but his rejection of the Kantian notion of the priority of concepts and conceptual structures that gives Piaget's epistemology such a strange appearance for the Anglo-Saxon philospher.

Hamlyn illustrates this very well when he argues that Piaget is to be regarded "as an essentially Kantian thinker" because, just as "... Kant's reconciliation between empiricism and rationalism came through the idea that experience is determined by categories which are a function of the human mind, so Piaget's reconciliation between empiricism and nativism comes through the idea that experience develops according to structures which are, likewise, a function of the human mind in its relationship to the world" (Hamlyn,1971:15). Yet it is precisely on this point that Piaget most decisively repudiates Kant. It is not the structures that direct cognitive development in Piagetian epistemology but the structuring activity of the subject. Piagetian structures are not at all to be likened to Kantian categories. Whereas Kant gives primacy to the categories, requiring the activity of thought to conform to them, Piaget, following in the tradition of Brunchschvicg and Cournot, gives primacy to the activity of thought making the structures subordinate to this activity that generates them.

Piagetian epistemology can neither be understood nor evaluated within the conceptual framework familiar to the Anglo-Saxon philosopher and commonly taken by that philosopher, with more than a touch of hubris, to be the only tenable framework for philosophical discussion in this enlightened 20th century. When such a philosopher attempts to come to terms with Piagetian epistemology while ignoring the fundamentally differing conceptions underlying that epistemology he must either fail to make sense of it - and so, most likely, conclude that it is philosophically uninteresting - or distort the Piagetian ideas, sometimes beyond all recognition other than an identity of terminology, in order to force them within an alien conceptual framework.

But this need not be an impenetrable wall cutting off all possibility of fruitful dialogue and comparative evaluation. It can be overcome provided we are willing to set aside dogmatism in favour of a critical attitude. A critical attitude in this connection is not to be confused with the position of "critical philosophy"; philosophers holding that position may fall prey to dogmatism as readily as any other. A critical attitude is the attitude that, without forsaking firm conviction for perpetual uncertainty, is ready to submit one's beliefs, theories and, above all, conceptual framework with its underlying assumptions to critical testing not once but repeatedly. It is the attitude that is genuinely ready for the evaluation and re-evaluation of one's ideas and conceptions that can come only as they are exposed to vigorous tests.

It is the attitude that will lead us, in debate with someone holding a different position, not merely to defend our position as strongly as we are able - something required of us if we are to advance the critical goals of the other - but also to be alert for defects and weaknesses in our own position that are exposed by the debate or for ways in which the other's position shows itself superior to our own.

In some cases this may lead merely to a strengthening of our arguments but, if our attitude is genuinely critical, it will also lead to more or less significant changes in the position we hold. The critical attitude likewise will lead us to look for other positions against which we can test our own by a critical comparison that looks not merely for the superior strengths of our own but also for weaknesses.

With regard to Piagetian epistemology such a critical attitude requires, before all else, that we set ourselves to understand it on its own terms within the philosophical context in which it has developed. Because of the wide divergence between that context and the development of epistemology in the English-speaking world since Kant this will mean for most philosophers trained in the English-speaking world putting to one side, for the moment, a familiar epistemological framework, with its underlying assumptions, in order to understand a different approach to epistemological problems, with a consequent redefining of the problems themselves.

It will mean setting aside the arrogance implicit in the view that ours is the only tenable philosophical framework in order to recognise and make the effort to become familiar with a quite different framework developed by others as rational as ourselves. Which is not to say that, having understood the alternative framework, we may not still return to our own as one we judge for appropriate reasons to be better.

However, it is only by momentarily putting aside our own framework in order to understand another's quite different framework that we can be in a position for critical evaluation that will advance our understanding of human cognition and not merely reinforce existing philosophical dogmas. It is only in such a way that a philosopher working within a different tradition will be able responsibly to evaluate the success of Piagetian epistemology in resolving its own agenda of

problems and, even more important, be able to evaluate critically the contribution it has made to the resolution of common underlying problems such as the problem of intersubjective universality or the problem of how knowledge claims are to be tested for their fit within the experiential universe.

This is not to suggest that the adoption of a critical attitude will lead us to the rationalist ideal of a unanimity among rational subjects. It is suggested that it will lead us to fruitful and mutually enriching dialogue that can only advance and sharpen our mutual understanding of human cognition. And it is suggested that, without it, there can only be mutual monologues to our mutual impoverishment.

3.1.2 Psychological Data and Piagetian Epistemology

A closely related question is the role of empirical data of a psychological nature in Piagetian epistemology. Enough has been said already to give the lie to the notion that Piaget's genetic epistemology is simply a developmental psychology under a somewhat misleading name. However, it is undeniable that psychological data has an important role in that epistemology - (See the discussion above in section 2.1.3).

As was noted earlier Hamlyn argues that the mixture of what he calls the "empirical and philosophical" in Piaget inevitably gives to his theory "a degree of incoherence" that involves "a muddle" (Hamlyn, 1971:12,23). He argues his case on the ground that "the philosophical and psychological questions which are at stake are different from each other, and that there are no grounds for the belief that philosophical questions can be answered by appeal to empirical evidence or vice versa" (Hamlyn,1971:19). According to Hamlyn philosophical questions must not only be distinguished from empirical questions but must be dealt with in isolation from them.

Toulmin, in a response to Hamlyn agrees with the distinction but

denies that Hamlyn's strict separation is desirable. He argues that interaction between the two is important for the growth of scientific knowledge. He agrees with Hamlyn that this results in a measure of incoherence in a new science like developmental psychology but argues that this initial incoherence is unavoidable if the new science is to grow (Toulmin,1971:27ff).

While Piaget is not entirely without fault in this matter, for reasons that will be discussed shortly, both Hamlyn and Toulmin fall prey, no doubt quite unwittingly, to the dogmatism that judges Piaget by the conceptual orthodoxy of their own philosophical tradition without taking critical notice of the very different philosophical tradition within which Piagetian epistemology was developed. They debate about Piaget within the conceptual context of their own common philosophical tradition as though this is the only existent conceptual universe without showing any recognition of the quite different context within which Piagetian epistemology was developed. The result is that while they debate <u>about</u> Piaget they fail to address the issues raised <u>by</u> Piaget.

As was discussed in the preceeding section, Anglo-Saxon epistemology since Kant, in general, while repudiating the Kantian system has adopted the Kantian conception of epistemology that sees it as concerned with the analysis of the conceptual - in some cases replaced by the lingual - structure of knowledge. This requires an autonomous conceptual - or lingual - realm, logically prior to experience, as the seat of cognitive normativity.

The debate between Hamlyn and Toulmin, though ostensibly about Piaget, is really about the relation between this autonomous conceptual realm and the empirical world. It makes sense only if we first accept the implicit ontological proposition that concepts or propositions have an autonomous existence.

Hamlyn argues for a rigorous separation of the conceptual and empirical realms. He does not, of course, deny all connection between them. He does not even reject all forms of interaction between them. He allows, for example, that demarcation disputes need to be settled by co-operative enquiries (Hamlyn,1971:5). He does insist that the normative investigations of conceptual analysis, on the one hand, and the factual investigations of empirical science, on the other, should each proceed by its own principles independently of the other. On this ground he is severe in his condemnation of the "muddle" of the philosophical and empirical that he finds in Piaget's epistemology.

Toulmin does not question the autonomy of the conceptual or the demarcation between philosophical and empirical but argues for more open borders. He argues that the conceptual analysis of philosophy, while proceeding by its own autonomous principles, needs to be open to the empirical so that the conceptual analysis takes place "in the light of the best empirical information" and, on the other hand, that empirical investigation without losing its autonomy needs to be open to conceptual analysis so that empirical questions are framed "in the light of the best available conceptual refinements" (Toulmin,1971:56). Consequently he has a more favourable judgment of the mixture of philosophical and empirical that he finds in Piaget.

As a debate within the philosophical tradition shared by Hamlyn and Toulmin this is all very much to the point. As a discussion relative to Piagetian epistemology it completely misses the point. That epistemology was developed within a philosophical tradition that rejected the Kantian conception of an autonomous conceptual realm and took its starting point instead in the Kantian conception of the activity of judgment which it makes into the autonomous source of cognitive normativity.

What is in question is not the existence of concepts or conceptual

structures as a component of our knowledge. Neither is the possibility of conceptual analysis in question. What is in question is the source of epistemic normativity.

In the philosophical tradition within which Hamlyn and Toulmin conduct their debate, the source of normativity is an autonomous conceptual realm. While they may dispute over the extent to which the analysis of this realm should be open to the empirical, in the final count it will be the analysis of the concepts and not any consideration of how these concepts are acquired by the subject that is decisive in determining the epistemic norms. Epistemology, properly speaking, can only be a matter of conceptual analysis, more or less open to empirical considerations.

In the philosophical tradition within which Piaget operated, the source of normativity is the activity of the subject that generates the conceptual system. There being no autonomous, independent conceptual realm there can be no debate about how open or closed its borders should be to the empirical. Given this view of the matter the analysis of concepts is epistemologically peripheral while the core of epistemology is the analysis of the activity of the subject that generates the concepts. What is epistemologically irrelevant, if not illegitimate, on the first view, becomes the indispensable core of epistemology on this second view.

Once we recognise this it is apparent that the real issue is not whether Piaget is muddled or lacking in philosophical discrimination. It is that he uses a different framework of discrimination.

Yet some blame must attach to Piaget for his failure to make clear in the presentation of his theory the underlying distinctions that are essential to it. He did use clear, systematic distinctions *which*, on the whole, he maintained with care in the development of his theory. However, in the presentation of his work he often failed to make the

distinctions clear, shifting his discussion from one area to another without any indication to the reader that he was making such a shift. This is a fault in presentation, however, rather than a lack of conceptual clarity in the development of his epistemology.

Piaget developed his epistemology with clear distinctions between philosophy, epistemology and psychology. If these are not the distinctions familiar to Hamlyn and Toulmin this is not because these distinctions lack philosophical sophistication but because they arise from a different, yet quite sophisticated, philosophical tradition that employs a conceptual framework unfamiliar to Hamlyn and Toulmin.

Philosophy, for Piaget, is the co-ordination of values, including but going beyond cognitive values, in a rational view of reality as a whole. It is both more limited and more comprehensive than science. It is more limited in that it can never achieve the intersubjective universality of scientific knowledge but will always be the wisdom of an individual or group. It is more comprehensive in that it achieves a view of the whole of reality such as science has not yet and probably never will be able to achieve (Piaget,1970b:114-115; 1972:57-63,281-307). On this view philosophy goes considerably beyond the conceptual analysis to which Hamlyn and Toulmin, true to their own philosophical tradition, would restrict it.

Epistemology, for Piaget, is a specific discipline concerned with the problem of the growth of knowledge; it addresses the question: How does knowledge grow, in its multiplicity and in the diversity of its development? (Piaget,1970b:121). Since there is no definitive state of knowledge but only a definitive epistemic activity of the knowing subject, epistemology is concerned not with the analysis of existent conceptual structures but with knowledge of the epistemic activity of *the subject* that is the source of norms generating these structures.

Given this view of epistemology the use of whatever data psychologi-

cal studies may yield to extend our knowledge of this epistemic activity is not only permissible but indispensable to epistemology. However, Piaget does not merge epistemology with psychology. There is an overlap, in so far as psychological studies provide data indispensable for epistemology, but the two remain distinct disciplines.

Not all psychological data is epistemologically significant but only such as is relevant to the problems specific to epistemology. Neither is epistemology merely a subdivision of psychology collecting and co-ordinating psychological data; it is a distinct discipline of an interdisciplinary kind that utilises relevant psychological data within its own distinctive systematics addressed to its own specific problems distinct from those of psychology (Piaget,1967:xi-xii; 1970b:118-142).

The psychological data that is of interest to epistemology does not constitute "a psychology of the individual" or the ingredients of such a psychology. This is a feature of the Piagetian distinctions that Hamlyn and Toulmin completely miss. Piaget's genetic epistemology is decidedly not a "theory of intellectual development in the individual" (Hamlyn,1971:3).

As the biochemist analyses the chemical structure of individual organisms not to provide data about the chemistry of these organisms in their individuality but for a universal theory of the chemistry of the living organism as a universal category, so the epistemologist analyses the cognitive activity of individual organisms not to provide data about their individual intellectual development but as the individual instances the universal structure of cognitive activity (Piaget,1966:329; 1983a:120). Psychological data relevant to epistemology is not the data of the psychology of the individual but the data of the cognitive universal instanced in the individual.

This, of course, is foreign to the conception of epistemic norma-

tivity with which Hamlyn and Toulmin are familiar, a conception that regards conceptual structures as the seat of normativity. However it makes eminently good sense on the alternative conception of the tradition of French-speaking philosophy within which Piaget worked that takes the cognitive activity of the subject as the source of universal epistemic normativity. On this view it is impossible to understand the epistemic norms by means of conceptual analysis alone and the kind of psychological data employed by Piagetian epistemology is an indispensable contribution to epistemology.

More is involved in the use of empirical psychological data in Piagetian epistemology, therefore, than is recognised by either Hamlyn or Toulmin. Piaget developed his epistemology with a whole set of philosophical conceptions that differ markedly from those taken for granted by Hamlyn and Toulmin because derived from a quite different philosophical tradition. His use of psychological data, though problematic in terms of the philosophical conceptions familiar to Hamlyn and Toulmin, accords well with the philosophical conceptions on which his work is based. Because of their failure to recognise this the debate between Hamlyn and Toulmin, though ostensibly about Piaget's theory, is conducted in terms of the problem structure of their own philosophical tradition while ignoring the quite different problem structure within which Piaget worked and without which his theory cannot be understood.

This results in a dogmatic approach to Piagetian epistemology that simply assumes a particular set of philosophical conceptions employed by the philosopher to be the only set possible for rational discourse and proceeds to evaluate the other person's work accordingly. The philosophical conceptions that have given distinctive shape to the other person's work are set aside on purely dogmatic grounds without critical evaluation. The inevitable consequence is that the analysis

remains superficial since it never penetrates critically to the underlying foundations of thought.

This dogmatic approach must give way to a critical attitude if the analysis is to gain effective depth. A critical attitude will never assume our own set of philosophical conceptions to be the only set possible for rational discourse. Encountering elements in another's thought that do not fit easily within our own conceptual framework we need to enquire carefully whether the other person is employing underlying conceptions that differ from our own that, if accepted, give a coherence to the other's patterns of thought that is lacking when we attempt to understand these within our own conceptual framework. Only then will we be in a position to undertake a comparative evaluation that replaces dogmatic defence of our own position with a critical evaluation of our own position as well as that of the other person. Dogmatic defence hinders the advance of knowledge by shielding theoretical foundations from the critical scrutiny that alone can uncover fundamental weaknesses.

With regard to Piagetian epistemology and the psychological data that it employs, we can make progress in evaluating the epistemological contribution only as we first evaluate it within the context of its own philosophical conceptions and then critically compare the solutions offered to common problems by this epistemology with others offered by epistemologies employing a different set of conceptions. This assumes of course, as has been argued already and as will be argued further in the following discussion, that there are common problems underlying the differences in problem formulation.

While he certainly did not deny that philosophical conceptions had a place in his and in all human thought, Piaget himself did not appear to recognise adequately their fundamental role in determining the problem structure of his own epistemology. He acknowledged the impor-

tance of philosophy both in identifying problems and in co-ordinating values, including cognitive values, in a coherent view of reality as a whole. For these reasons he regarded philosophy as indispensable to any rational person (Piaget,1972:57-63,307). However, he insisted that it is possible to develop an epistemology that transcends the inevitable differences in philosophical positions by proceeding step by step with carefully delimited problems on which agreement can be reached regardless of philosophical position. This is the basis for the "scientific epistemology" which he saw as displacing philosophical epistemology (Piaget,1970b:111-116).

What Piaget appears to have missed is that, while there may be agreement that a problem, delimited in the way he proposes, is a real problem worth investigating, whether or not it is regarded as a meaningful epistemological problem is dependent on the framework of philosophical conceptions employed. Hence problems that, within Piaget's framework of philosophical conceptions, are fundamental epistemological problems, when viewed within another framework become psychological problems, with, at best, peripheral epistemological relevance.

3.2 THE RATIONALITY OF THE KNOWING SUBJECT

It is usually assumed, even within irrationalist epistemologies, that there is a rational component to knowledge; knowledge is not regarded as a matter of pure irrationality. Indeed, there seems to be little point in epistemological discussion if knowledge is wholly without the qualities of coherence and constancy associated with rationality. Even Feyerabend with his anarchist alternative to rationalist epistemologies appears reluctant to banish all rational factors from cognition. If he were to do so it seems clear that he could not offer an epistemological alternative but only the abolition of all epistemology. What is widely disputed is the exact nature and role of this rational component.

3.2.1 A Constructivist Rationality

Piagetian epistemology is based on the view that the rational component is the structuring activity of the knowing subject founded in the lawful structure of the living organism. This structuring activity of the subject generates the formal systems that are the positive cognitive norms. The universal force of these positive norms derives from the universality of the structuring laws of the subject's activity - the epistemic subject - that generates them.

The lawfulness of the structuring activity of the subject, a lawfulness inherent in organic life, is an important feature of the Piagetian foundations. Piaget (1974a:315) criticises Brunschvicg for representing the constructive activity of the subject as free and without direction. In his anxiety not to restrict the creative activity of the knowing subject by enclosing it within a predetermined formula Brunschvicg gives a radically contingent character to intellectual development that runs the risk of falling into the irrationalism of the Bergsonian élan vital.

For his part, Piaget seeks to avoid this risk by insisting that the constructive activity of the subject, though in no sense predetermined, is an orthogenetic development subject to laws of equilibrium. These laws in no sense determine the direction of cognitive development, either by fixing a priori categories or by a teleological determination, but are functional laws ensuring that cognitive development moves constantly toward forms of equilibrium having common characteristics. The constructive activity of the subject is lawfully guided by principles internal to the living organism without being determined (Piaget,1974a:315,316).

There is no room in Piagetian epistemology for the pure observation of empiricism; there are no sensory impressions registering themselves in the mind independently of the subject's activity. The most primi-

tive observation involves a primitive ordering of reality by the co-ordination of the subject's actions. More extended observations depend on an extended co-ordination of the subject's actions.

While knowledge thus has a constructive character, dependent on the construction of a rational order by the subject, it does not create the world of objects ex nihilo. The subject constructs the forms for which the material object world supplies the content. Without the content supplied from the material object world through sensory perception the forms will be only empty forms. Even more than this, without a material object the forms could not exist at all, except in their most primitive form as primitive sensory-motor co-ordination, since it is only in the interaction of the subject with the material object world that the forms are constructed. Only as the existing forms prove inadequate for the assimilation of the material object world encountered in the subject's experience of that world is the subject motivated to expand the forms to accommodate all the content of the experienced world of material objects. Conversely, every expansion of the forms increases the content of our knowledge by increasing the range of observations that we are able to make.

Knowledge, then, is a spiralling activity of the subject assimilating the material content of experience within the formal structure of experience supplied by the co-ordinated activity of the subject and, in order to assimilate unassimilable content, expanding and refining this formal structure with additional co-ordinations that yield in turn new material content requiring a further expansion of the formal structure. This spiralling process is guided constantly by a universal rationality inherent in the subject and consisting in laws of equilibrium intrinsic to the living organism (see the discussion above in section 2.1.5 and again in section 2.5).

At the highest levels - when we reach scientific knowledge - the

forms resulting from the constructive activity of the subject are formalised in formal logico-mathematical systems. It is not the formal system, however, but the constructive activity of the subject formalised in the formal system that is normative.

This question of formalisation highlights the gulf that separates the philosophical tradition within which Piaget worked from the analytical tradition that provides the background to epistemological discussion in the Anglo-Saxon mainstream. In the latter case a formal system formalises logical rules of language by which we may test the logical structure of linguistically formulations of various kinds. In the case of Piagetian epistemology, a formal system formalises the structuring activity of the subject; it is not logical rules of language but the structure of the subject's structuring activity that is formalised and the acceptability of the formal system depends on its isomorphism with the subject's structuring activity (Piaget,1973a:7). We are faced again with the consequences of the different point of departure in the Kantian revolution.

Guided by the inherent rationality of the co-ordinated activity of the subject, knowledge develops, in Piagetian epistemology, from primitive observation, with its pseudo-necessities and pseudo-impossibilities, beyond inductive generalisation to the rational explanations of scientific knowledge characterised by the certitude of a genuine deductive necessity. "Necessity" is a more fundamental concept in Piagetian epistemology than "objectivity" because it is the necessity intrinsic to the universal rationality of the subject that secures the intersubjective universality of knowledge by eliminating the cognitive distortions of subjectivity. Objectivity is dependent on the deductive necessity that is generated by the universal rationality of the subject and gives the basis for rational explanation of our experience of reality (Piaget,1973:7-18).

This necessity is never an absolute necessity since, the cognitive spiral remaining always open-ended, the ongoing interaction of subject and object may always surpass the present necessities with new necessities. This does not, however, abolish the present necessities but transforms them into new relativities by combining the old with the new in new and more complex co-ordinations of the subject's activity. Knowledge is thus an open-ended process the rationality of which is secured by the rationality of the subject's knowing activity founded in universal biological laws of equilibrium.

This invites comparison with Popper's notion (1979:106-118; 1983:97, 98) of dispositions as a "biological analogue" of scientific knowledge. Piaget's biological reference differs from Popper's in two important respects. In the first place, whereas Popper finds only a biological analogue of scientific knowledge Piaget finds biological roots of scientific knowledge; the development of scientific knowledge is the development of the rationality inherent in the biological functioning of the organism. Scientific knowledge does not, as it does for Popper, constitute objective knowledge by transcending the knowing subject; it gains objectivity by the development of the rationality of the subject, remaining always the knowing of a subject.

Secondly, whereas Popper's dispositional knowledge develops by trial and error as the organism responds conjecturally (Popper,1983:xxxv) to external stimuli, on Piaget's view knowledge develops in accordance with a universal rationality inherent in the organism that acts on - rather than reacting to - the environment.

3.2.2 The Subject as Rational Critic

When we turn to Karl Popper we find a continuity with the Logical Positivim of the Vienna Circle that was the immediate context of his intellectual development but also a marked discontinuity with that tradition. The continuity is evident in his restriction of epistemo-

logy to a methodology. The task of a theory of knowledge is "the analysis of the method or procedure peculiar to empirical science" (Popper,1980:39,51).

The restriction of epistemology to the analysis of scientific method that is characteristic of, though not exclusive to, Logical Positivism, does not imply for Popper the restriction of knowledge to scientific knowledge. Scientific knowledge is an extension or development of common sense knowledge though in this development it transcends common sense knowledge. While it would be possible to analyse common sense knowledge this must always miss the most important and exciting problems of epistemology. In particular it will miss the main issues related to the growth of knowledge since "the most important way in which common-sense knowledge grows is by turning into scientific knowledge" and, in doing so, transcending the knowing of the subject. It is, then, because scientific knowledge is the most highly developed knowledge that the analysis of its method elucidates the problems of knowledge most effectively, including the problems of common sense knowledge but adding the more important and exciting problems that "must remain completely invisible to those who confine themselves to analysing ordinary common-sense knowledge" (Popper,1980: 18,19).

In developing his ideas Popper made a sharp distinction between common sense, or subjective, knowledge as a World 2 activity of subjects and objective, scientific knowledge of World 3 (Popper,1979:106-150; 1983:92-103). However, it is important to note that, while he maintained that objective knowledge constitutes an autonomous realm that transcends the knowing subject (individually and collectively) he maintained an open border between objective knowledge and the knowing subject.

Without subjective knowledge - the knowing activity of human subjects - objective knowledge could not grow (Popper,1983:96); it is a

human product, resulting from the knowing activity of human subjects, even though once created it takes on an autonomous identity of its own that makes it independent of its creators (Popper,1979:158-163).

Secondly, the objective knowledge of World 3 - theories, ideas, critical arguments - is accessible to the knowing subject of World 2. It is, indeed, "one of the main functions of the second world to grasp the objects of the third world" (Popper,1979:156). Subjective knowledge depends for its growth on the objective knowledge of World 3 (Popper,1979:74). The human subject both uses and critically tests the objects of World 3 some of which are "incarnated" in the subject (Popper & Eccles,1979:537).

Objective, scientific knowledge, in Popper's theory is an autonomous realm distinct from the knowledge, or the knowing, of the human subject yet existing only in interaction with the knowing subject who is both producer and critic of objective scientific knowledge. There are two distinct realms with entirely open borders (Popper & Eccles,1977: 36-50,171,537-538).

The identification in Popper of epistemology as methodology reflects the positivist tradition going beyond Logical Positivism as far as Comte. While this tradition has been discussed previously its importance in the present context warrants a brief review. This tradition took its starting point in the view, that the rationality of (scientific) knowledge is due to its conceptual structure; a view already advocated by Kant. This led to the preoccupation with conceptual analysis in the search for cognitive normativity.

The rejection of the Kantian notion of an innate conceptual structure, however, required a new basis of intersubjective universality founded in a universal, self-authenticating rationality if the rationalist character of knowledge was to be preserved. Positivism claimed to have found this basis in a universal method the rationality of

which was endorsed as self-evident by the universal intuitive judgment of rational subjects.

The Comtean version of positivism soon got into difficulties and Logical Positivism was an attempt, the last great attempt, to salvage the notion that the universal rationality of knowledge can be secured by founding the conceptual structure of knowledge in a universal rational method of verification. Fundamental to this attempt was a sharp observation/theory distinction. Suppe (1977:67-80) maintains that the Kantian analytic/synthetic distinction underlies this observation/theory distinction. Be that as it may, the observation/theory distinction was used in Logical Positivism to secure, it was thought, the intersubjective rational universality of scientific knowledge on the one hand, by restricting the empirical component of that knowledge to unambiguous observations and, on the other hand, by conforming its conceptual structure - its theories - to the requirements of an axiomatic formal logic, the axiomatic character of which is recognised by all rational subjects.

Popper remains within this tradition in that he retains the view that epistemology is the methodology of scientific knowledge, the theory of scientific method. He also remains in the mainstream of this tradition in his insistence that the decisive concern of epistemology is the analysis of conceptual structures and their logical relations with experimental observation (Popper,1979:111,157,166). At the same time he makes a decisive break with this tradition in rejecting both the notion of unambiguous, theory-free observations and the notion of a conceptual (theoretical) structure the universal rationality of which is secured by an axiomatic logic (Popper,1980:16; 1983:xxiii). In this last connection, however, it should be noted that Popper is concerned only with conceptual structures as linguistic formulations.

In making this break Popper shifts the rational control of knowledge

from an intersubjectively endorsed method to the rational judgment of the knowing subject. He still gives a crucial role to what he calls a method, the method of criticism (Popper,1983:163) but the relative roles of the method and the knowing subject have changed decisively.

In the positivist tradition, including Logical Positivism, the rational method provided a subject-independent knowledge. The role of the subject was confined to endorsing the rational credentials of the method. Once endorsed as the universal rational method the method functioned as a rational control independently of the subject who employed it; all that was required of the subject was to follow the method with meticulous care for the right results to be assured much in the way as a well constructed computer program will yield the correct results independently of the operator provided only that the operator takes care to follow the prescribed procedures.

Popper's critical method, on the other hand, depends on the active involvement of the subject, not only in constructing falsifiable theories and devising stringent tests but in judging the results of these tests. It is a subject-dependent method in contrast to the subject-independent methods of the positivist tradition. The rigorously applied critical judgment of the subject is decisive in ensuring the rationality of knowledge. Logical analysis is one test that may be used by the subject in the criticism of theories but it has no privileged place. Any method is legitimate provided it facilitates critical testing of knowledge (Popper,1980:16f; 1983:xxxv).

The ultimate foundations of knowledge are the the living organism's innate dispositions to act. These constitute the most primitive theories preceeding all observation. The organism acquires additional knowledge through trial-and-error modification in interaction with the environment. Persistent disappointments of the dispositional expectation (refutations) lead to modification of the disposition whereas

those not disappointed are retained. A modification of a disposition as a result of the experience of persistent error is not made on any rational principle other than that correction must be made for persistent error; the correcting modification is nothing but a guess, a conjecture (Popper,1979:25,71; 1983:xxxv).

The rationality of human knowledge depends on the ability to formulate knowledge in language in forms that are "objectively criticizable" (Popper,1983:xxxxv). The linguistic formulation of knowledge makes the exercise of rationality possible by objectifying the dispositions as linguistically formulated problems, theories and propositions. Though essential to rationality this linguistic objectification of knowledge does not of itself constitute cognition as a rational enterprise. Primitive myths and scientific theories equally belong to this objective world of epistemic formulations. What constitutes the rational epistemic enterprise is the systematic criticism of epistemic formulations, systematic attempts to falsify theories. This requires that we formulate them in criticisable, that is in falsifiable, formulations. The notion of falsifiability of theories as the demarcation criterion of science as rational epistemic enterprise is such a dominant theme in Popper's published works that it is pointless to give specific references. It is important, however, to note carefully that this falsifiability "is a purely logical affair. It has to do only with the logical structure of statements and classes of statements" (Popper,1983:xx). It concerns the rational imperative of "falsifiability" that has nothing to do with whether there is an empirical means of falsification. The linguistic formulation of dispositions should have a logical structure such as to facilitate critical testing.

The formulation of theories with a criticisable logical structure is an essential pre-requisite to the exercise of cognitive rationality since without this there is no object of criticism. The rationality

that distinguishes science as a rational epistemic enterprise from mere animal cognition and mythological forms of human cognition, however, consists in the critical judgment of the knowing subject directed toward these linguistic formulations as its object. Without this critical judgment and beyond this there is no rationality of cognition. The human "powers of reasoning are nothing but powers of critical argument" (Popper,1979:121 - also 1979:24,25,146,347,348; 1980:16,17; 1983:7,27).

In an illuminating passage Popper refers to the decisive role Kant gave to the autonomous judgment of the subject in matters of ethics and religion - "... it is you ... who must judge" - and suggests that it is a major defect of the Kantian system that he did not extend the same principle to the field of scientific knowledge (Popper,1972:26, 27). Popper, however, wishes to restrict the authority of this autonomous judgment to the critical role of preferential judgment based on methods of error detection.

Popper defends a rationalist epistemology but by comparison with the older forms of rationalism it is an attenuated rationalism. All the older forms of rationalism gave rationality a decisively constitutive role in cognition. Popper reduces the role of rationality to a critical sorting role based on error-finding without constitutive authority. As he puts it himself, his stress is on the "negative" function of reason (Popper,1983:27).

When this is taken in conjunction with what he has to say about the role of decision and conventions in science and in his own theory (e.g. Popper,1980:49-56) it would be easy to conclude that Popper has altogether forsaken rationalism for irrationalism. This is a conclusion that Popper himself rejects most vigorously regarding himself (1983:177) as a defender of rationalism against irrationalism "... one of the last laggards of the Enlightenment ..." (see also Popper,1980:

5-19; 1983:xxiii,27,28). His intention to remain within the rationalist tradition is beyond doubt. However, the question is whether he has achieved this intention or whether, in spite of it, he has adopted what must be regarded on close analysis as an irrationalist position.

If we limit the possibilities of rationalism to a position in which the rational governing principle is either an a priori conceptual structure or an a priori rational method then Popper has clearly forsaken rationalism. He has no place for either a priori concepts or an a priori method (Popper,1980:15-23; 1983:261,262).

The existence of a third sub-type of modern rationalism, however, has emerged from the study of Brunschvicg and Piaget; a rationalism in which the governing principle is an innate dynamic principle of rational constructive activity that is neither identifiable with conceptual structure nor with method. Popper, however, clearly does not espouse a rationalism of this type either.

Does this leave Popper with anywhere to go and still maintain any kind of rationalist position? It certainly leaves him with very little room to move but within the limited space left he has mapped out a position which, in my view, is to be regarded as rationalist in character, albeit an attenuated rationalism.

So far as the constitution of knowledge is concerned he denies all universal, self-authenticating rational authority. All is pure conjecture. He neither substitutes the authority of commitment, as does Polanyi, nor some other aspect of the subject's functioning, but he dismisses as illusory all authority with regard to the constitution of knowledge. In this important respect he has abandoned the rationalist ideal of knowledge invested with a certainty secured by a self-authenticating rationality, and come to the border of scepticism - as he admits (1983:19,20).

He retains rationality, and cognitive authority, only as a critical,

error-detecting function. Rationality cannot establish truth but it can detect error and, in doing so, enables us to approximate truth more closely. The crucial question is whether this critical rationality, which is the only rationality we have, is a universal, self-authenticating rationality or is merely a tool in the hands of the knowing subject who, in the end, is governed by an extra-rational principle in its use. If the second is the case then clearly, whatever he may claim to the contrary, Popper's position is irrationalist. If, however, the first is the case then his position must be regarded as a fourth sub-type of modern rationalism.

While Popper does not give an explicit answer to this question put in this way, it seems to me that the use he makes of the notion of critical rationality and its function in cognition, employing it as his wall against scepticism and irrationalism, makes it clear that he take it as having a universally autonomous, self-authenticating character.

It is this critical rationality that distinguishes the human from the merely animal, enabling the human subject by transcending the subjectivity of the self to contribute to the growth of science as wholly objective knowledge (Popper,1979:120-122; 1983:154-156). It is important to recall at this point that while World 3 objective knowledge is distinguished from the knowledge of the human subject it is in no sense isolated from the subject. On the contrary, the subject acts on the objective knowledge of World 3, formulating and reformulating the theories of that World and, above all, employing the critical arguments of that World in the error-detecting testing of these theories (Popper & Eccles,1977:36-50).

This error-detecting activity of critical rationality has the character of "objective rational criticism" (Popper,1983:xxxii,xxxv) leading to a preference for certain theories that rests on valid reasons,

not as "positive" reasons but as "critical" reasons (Popper,1983:20, 25,26). It is by this self-transcending critical rationality that science advances rationally (Popper,1983:xxiii).

Having regard to the self-transcendent and objective character that Popper thus gives to his critical rationality and the grounding of its judgments in "reasons" - reasons that he appears to regard as compelling for all rational subjects - it seems to me that it would be misrepresenting him to argue that he reduces rationality to a mere tool of the human subject. It is rather to be regarded as a universally autonomous self-authenticating rationality by which the subject is governed in the only cognitive activity in which subjectivity can be transcended - the activity of rational criticism.

It may be argued, as I myself would do, that Popper maintains his rationalism by a wholly unsatisfactory weakening of the concept of rationality. It may also be argued, as again I would do, that the position he has taken up as a last ditch stand in defence of rationalism is a position without adequate defences against irrationalism. However neither of these arguments affect the conclusion that, however unsatisfactory it may be, the position he has adopted has a rationalist character.

It should be noted that his rationalism does not depend on the truth or correctness of his own theory that, by the very conditions of that rationalism, can only be a conjecture. Popper's rationalism, like all forms of rationalism, rests on the supposedly self-authenticating character of rationality and not on a theory about rationality. It is no argument against Popperian rationalism, therefore, to point out the conjectural nature of his own theory. A more serious difficulty, which Popperian rationalism shares with all forms of rationalism in today's pluralist world of thought, is the widespread failure of apparently rational subjects to recognise the credentials of this supposedly

self-authenticating rationality.

3.2.3 Rationality with Fiduciary Roots

Michael Polanyi, as a representative of the important, but diverse, irrationalist movement in contemporary epistemology that denies the existence of a self-authenticating, autonomous rationality, does not deny a rational component in cognition but rejects the notion of the autonomy and independence of rationality and hence its cognitive authority.

There is, he argues, a "fiduciary rootedness of all rationality". In an extensive critique of the Cartesian notion of philosophical doubt as the method of rational certitude he argues that the certitude that results from this method is not due, as its advocates mistakenly claim, to a belief-independent rationality but rather to the beliefs in which the rationality of the method is founded. Philosophical argument remains rational only as it serves, and is seen to serve, the interests of the beliefs in which the rationality of the argument is rooted. As soon as it pretends an autonomy independent of its fiduciary foundations it ceases to be rational to become a mere dogmatic assertion of beliefs falsely claiming to be a belief independent rationality (Polanyi,1962:269-298).

In the final count, to be rational is to act consistently and coherently in accordance with one's beliefs. Man is rational "only to the extent to which the conceptions to which he is committed are true" but this is to be understood in terms of a redefinition of the meaning of truth (Polanyi,1962:112). In this redefinition "true" expresses "the asseveration of the sentence to which it refers". This comes down to saying that a statement is true if and only if the person making the statement believes that it corresponds to a genuine state of affairs. This is made plain when Polanyi tells us that his redefinition of "true" can be expressed by a reformulation of Tasski's definition as

"I shall say that `snow is white' is true if and only if I believe that snow is white" (Polanyi,1962:255). Rationality is wholly subordinate to and can be employed only in the service of our beliefs.

A primary function of rationality is the formation and application of rules of procedure that allow us to proceed in an orderly manner in accordance with our beliefs. These may be the rules of rightness of formal logical systems that guide our reasoning in an orderly fashion or the procedural rules of the scientific community for testing a proposed contribution to science in an orderly way (Polanyi,1962:333; 1969:75). But these procedural rules that secure the rationality of science lack both the definitive authority of the methods of the positivist tradition and the critical authority of Popper's rational error-testing. Ultimate authority rests with our beliefs; rationality is an instrument for ensuring the orderly procedure of cognition in accordance with those beliefs.

Polanyi does speak of the inherent rationality of modern science, a rationality that transcends the senses, as a virtue of modern science making it superior to other forms of knowledge about the material world (Polanyi,1962:10-13). However this superior value that he gives to science is not based on the credentials of the rationality of science as a self-authenticating rationality but rests on a personal commitment, a set of beliefs, that gives higher value to knowledge having this quality of rationality (Polanyi,1962:viii).

As important as it is for Polanyi, rationality, in the final analysis, is nothing but a fiduciary instrument employed by the knowing subject in the interests of his beliefs.

3.2.4 A Comparative Summary

One of the significant points of convergence between Piaget, Popper and Polanyi is the agreement in rejecting the notion of rationality as

the source of subject-independent standards, fixed subject-independent criteria imposing their authority on the subject. This includes the rejection of positivism's subject-independent methodological criteria as well as the conceptual criteria of earlier rationalism. For all three rationality is a quality of the subject's activity.

This does not mean that they deny all objective rationality to reduce rationality to nothing but a quality of the subject's activity. Piaget recognises a limited rationality of the object as a subject-independent reality that functions as "limit" in the subject's knowing. Popper's World 3 of theories, problems and propositions has an autonomous, objective rationality of its own independently of the subject. Polanyi believes in a rationality of nature that is beyond the subject's understanding. Yet in no case does this external rationality impose standards or criteria on the subject's cognitive activity in the manner of positivism and its older rationalist predecessors. The subject acts with a rationality intrinsic to its own activity.

Beyond this convergence, however, the three diverge widely in their account of the nature of this rationality of the subject. In Piaget it is a constructive rationality that guides the formation of knowledge according to rational laws of equilibrium. In Popper it is restricted to a critical rationality that does nothing to govern the formation of knowledge but selects from among the already formed units of knowledge by rejecting those that fail to pass its tests. In Polanyi it lacks all autonomous authority and is merely a fiduciary tool.

It is clear that these three views are incompatible. Piaget stands closest to the earlier rationalist tradition which had always held to a rational formation of knowledge. Polanyi's irrationalism abandons the rationalist tradition altogether while Popper's attenuated rationalism comes somewhere between the two. As well as being incompatible, are these three theories of rationality also incommensurable, or is it

possible to find a way of comparative evaluation?

Certainly if we are to engage in a comparative evaluation that is anything other than a dogmatic defence of one or another of the three theories we will need to find a standpoint for doing so that is external to each of them. Piaget could claim that the extensive experimental research in genetic epistemology is compelling evidence in support of his theory. Popper could respond that impressive as this evidence is in terms of sheer quality and carefulness of detailed experimental research, it is worth only as much as the guesses on which it is based. Polanyi could reply by applauding Piaget's passionate commitment to his set of beliefs as evidenced by his lifetime of research but point out that this very commitment refutes his theory of rationality by showing its fiduciary roots. Of course, Piaget would have his own responses to each but these would be no more compelling to them than their arguments would be to him.

Or Popper might marshall all his best and most compelling arguments in favour of his theory. Piaget could respond, as he has (Piaget,1983: 293), by saying that all these arguments, logically well constructed though they are, miss the point because they address the wrong problem; they proceed on the mistaken assumption that the basic epistemological problem is a methodological problem. Polanyi could respond by admiring the skill with which Popper employs his logical tools in the cause of his beliefs but point out that, in the end, the force of these skilful arguments depends on a commitment to the beliefs in the service of which the logic is employed; and he might even end by quoting in support Popper's own fiduciary assertion of his disbelief in belief, as a statement out of his own mouth, clearly fundamental to Popper's theory (Popper,1983:21,22). Again, Popper would have his counter-responses that would start the whole cycle of response and counter-response going again.

By this time Polanyi might well be thinking that he has the other two cornered and point out that it is clear that the only way out of the impasse is to recognise that their differences are due, in the final count, to differences of belief, and identifying these differences in belief in support of his argument; an argument which, if accepted of course, would amount to conceding that his theory is the correct one. But he would not find them so easily cornered. Both Piaget and Popper could respond that they have never denied the role of beliefs in the background or the context for their epistemological theories, but that these background or contextual beliefs do not have the determining role in their theories that Polanyi's theory requires. Their recognition that cognition is controlled by an autonomous rationality that functions within a fiduciary context is very different to Polanyi's claim that rationality is subordinated to an autonomous fiduciary commitment. In the one case rationality functions on its own autonomous principles within a fiduciary context while in the other case rationality loses its autonomy to become a mere tool of an autonomous fiduciary commitment. Detailing differences of belief, therefore, does not compel acceptance of Polanyi's theory since such differences are equally compatible with the other theories. As in the other cases this might well lead on to an endless chain of argument and counter-argument.

There is, then, an incommensurability between the three theories of rationality in the sense that reasoning from within each of the theories can never give us a basis for deciding between them; the same considerations that, when dealt with within the logical structure of one theory, forge a compelling case in support of that theory, when transposed to the logical structure of another provide an equally compelling case refuting the first and supporting the second. The question is: Can we identify a basis independent of but compatible

with the internal logic of each from which we can engage in a critical evaluation without merely introducing another incommensurable theory?

This is an important question to which we will return later (in section 4.3.7). Whatever its strengths and weaknesses the long rationalist tradition did give a coherence to human intellectual endeavour in the common conviction that there are subject-independent epistemic criteria with compelling authority for all rational subjects. Unless that tradition can be revived in a new and convincing form or an alternative basis found for intersubjective, intertheoretic evaluation of theories we appear to be headed for an increasing fragmentation of the human epistemic enterprise into competing sects, each with its own irrefutable set of dogmas and with increasingly less ground for co-operative endeavour.

3.3 THE INTERPLAY OF RATIONAL AND EXTRA-RATIONAL

However we view the rationality of the knowing subject it is evident that the subject, as human subject, exhibits other characteristics that cannot be subsumed under rationality even if it should be thought that they can be subordinated to rationality. The question then is: What is the relationship between these extra-rational factors and the rationality of the knowing subject?

Are they features of an incorrigible irrationality that must be isolated from the knowing subject in order that knowledge may have the desired quality of uncontaminated rationality? Or do they have a subordinate role in cognition in subjection to rationality and if so of what kind? Or is the controlling factor in cognition extra-rational with rationality subordinate to this extra-rational quality and, if so, what is the exact nature of this controlling quality?

3.3.1 The Extra-Rational as Epistemic Framework

One of the striking, and admirable, features of Piaget's work was his

openness to adjust and modify his theory in order to accommodate new material that came to his notice. The basic contours remained unchanged from the time that he made the decision to follow the historico-critical path in developing a scientific epistemology, but this left considerable room for reshaping as the detailed structure of the theory took shape. He said himself in 1970 that "`Piaget's theory` is not completed at this date and the author of these pages has always considered himself one of the chief `revisionists of Piaget`" (Piaget, 1970d:703).

On the question of the cognitive role of the extra-rational he introduced a most important modification to his theory in the very last years of his life when he introduced the notion of an "epistemic framework". Garcia, who was one of Piaget's closest and most respected collaborators in those last years - excepting, of course, his most enduring colleague Bärbel Inhelder who undoubtedly held his highest regard to the end - recounts the circumstances in which he was constrained to introduce this notion (Garcia,1983:17).

In Piagetian epistemology cognition is a strictly rational process governed from first to last by the logic intrinsic to the activity of the knowing subject. Anyone studying Piaget's earlier works could be pardoned for concluding that he regarded this rationality of the knowing subject as a self-contained rationality from which all extra-rational influence is excluded. Indeed it appears that Piaget himself did see the matter very much along these lines. All knowledge claims that admit the influence of the extra-rational in the formation of the knowledge are to be rejected.

He acknowledged that the human subject in its extra-cognitive functioning can generate cognitive problems, and, in doing so provides an indispensable stimulus to cognitive activity. However it is to philosophy that he gives this indispensable problem-generating role and

while philosophy is not a cognitive activity it is a rationally governed activity - "une prise de position raisonnee" (Piaget,1966:77,78; 1972:57-63,281,307).

In this important Piagetian distinction between a cognitive rationality characteristic of science and a philosophical rationality that embraces values that transcend knowledge it is tempting to see a variation of the Kantian distinction between theoretical and practical reason. On closer examination, however, it is clear that such a view is quite misleading.

Following Brunschvicg Piaget rejected the Kantian division of rationality into the autonomous faculties of understanding and reason, theoretical and practical, that are co-ordinated by the third faculty of judgment. What Kant parcelled out between autonomous faculties Piaget, following Brunschvicg, united under the absolute primacy of judgment in the form of the constructive activity of the rational subject. Science and philosophy are distinguished in that one constitutes knowledge while the other is reflection but the distinction does not rest on the employment of distinct rational faculties. Each is directed by one and the same active rationality (see Brunschvicg,1951-8:Vol.2,59-70). The distinction, according to Piaget, arises because this one active rationality is directed toward different objects requiring the use of different methods.

Philosophical rationality has for its object the whole of reality, embracing the whole of the human subject in all its dimensions and the whole of reality external to the subject, together with all possible relations between them. Its object includes what is known but also includes those features of experienced reality that lie for the present beyond the reach of even the highest powers of cognition, those of science. The qualification "for the present" does not imply any prescription that all reality can be brought eventually within the

scope of science. It implies no more than that we have no basis for predetermining what features of reality that are today beyond the reach of science may be tomorrow brought within its reach. In order to achieve its goal of a rational synthesis that embraces the whole of reality philosophy can only employ the method of reflective analysis. (Piaget,1970b:114-118; 1973b:13-18).

Science as the highest level cognitive activity on the other hand, has always a limited object. It limits itself to specific, limited problems that can be resolved within their specified limits to the satisfaction of all rational subjects by the use of agreed intersubjective tests, both deductive and experimental. This distinguishes science as cognition from philosophy as rational co-ordination of the cognitive with what lies beyond present cognition.

It should be noted that while philosophy and science are distinguished by the employment of different methods one method is not regarded as more rational than the other. It is not the logic of the method but the intrinsic logic of the active subject that ensures the rationality of thought. The difference in method is determined simply by the difference in the objects toward which thought is directed. One method is not more nor less rational than the other.

Science (knowledge) and philosophy are not distinguished by a greater and lesser degree of rationality. Neither are they distinguished by the employment of different faculties of rationality. They are distinguished, in the last analysis, by the different objects toward which one and the same rational activity of the subject is directed. Even this difference in the objects is not a difference of distinct entities. The reality that philosophy takes as object in its totality is the same reality that science takes as object in its differentiation.

The border between the two, therefore, is indefinitely open and

fluid with an indispensable interaction between them. Science needs the stimulus of philosophy for the identification of its problems while philosophy advances as it incorporates the solutions of science in its rational synthesis. In all this there is an interaction of a cognitive and a reflective rational activity but no interaction of rational and extra-rational.

Piaget may appear to admit an extra-rational factor when he acknowledges a role in cognition for the free choice of the subject (Piaget, 1970:7,8). Yet examined more closely this appears to amount to no more than the admission of an element of contingency in the logic of the subject ensuring that cognitive necessity, instead of leading toward a closed, necessary system, functions always within a spiral opening on ever new possibilities.

So far, then, the Piagetian picture is of a complex, all-embracing rationality that, in its cognitive functions, is isolated from the extra-rational. It is a picture which would be supported by a study of much of the Piagetian corpus. There are occasional suggestions that cognitive development is subject to extra-rational influences of a social and cultural nature but these influences appear to be restricted to facilitating or retarding the development of the cognitive instruments in the subject rather than affecting the acquisition of knowledge by means of these instruments (Piaget,1970b:64-79).

The introduction of the notion of an "epistemic framework" admitted a more far-reaching role for extra-rational factors. It is now admitted that extra-rational factors can not only determine the development of the conceptual instruments necessary for the higher levels of knowledge but also that, even where these instruments are well developed, extra-rational factors play a significant part, even a decisive part, in determining how they will be employed in the acquisition of knowledge.

In connection with this notion of "epistemic framework" Piaget identifies two factors. One factor, external to science but exercising effective pressure on scientific activity, he designates "social paradigm". This covers all those social and political pressures that orient scientific research toward certain problems and themes while neglecting others deemed socially less valuable. The other, because it is internal to science, he designated "epistemic paradigm". This constitutes the set of ideas, concepts or themes that, at a given historical moment, are accepted as scientific.

The epistemic paradigm determines what counts as "scientific"; the social paradigm determines what lines of scientific enquiry are worth investigating. Between them they constitute an epistemic framework that controls the growth of knowledge by determining the kind of problems that are to be investigated by science (Piaget & Garcia,1983: 275-285).

This epistemic framework is not a product of the internal logic of the knowing subject but has the character of an ideology, a Weltanschauung, shaped by extra-rational factors of a social, political or religious nature. It does not affect the rational mechanisms by which the subject acquires knowledge but it nevertheless exercises a powerful influence on the acquisition of knowledge by directing the subject toward certain problems, objects and situations as legitimate and desirable objects of cognition while putting insuperable obstacles in the way of other lines of enquiry. It constrains the operation of the rational mechanisms within an accepted conceptual framework that endorses one set of concepts as "evident" and another as "absurd" on ideological rather than rational grounds.

In short, while the knowing subject is always a strictly rational subject governed by the universal logic of its own activity, its field of activity is determined by an ideologically shaped epistemic frame-

work that imposes extra-rational limits on the scope of cognitive activity.

3.3.2 The Extra-Rational as Epistemological Background

Popper claims - or perhaps we should say, conjectures - that knowledge originates in the extra-rational, in the first place as inborn dispositions. These dispositions are activated as expectations or anticipations which are psychological or biological analogies of hypotheses; an expectation, consisting in the readiness of an organism "to act, or react, in response to a situation of a certain specific kind", may be either conscious or unconscious.

These inborn dispositions form the base of all knowledge. As the organism acts in accordance with these dispositions the success and failure it meets leads it to modify and develop the inborn dispositions which, having a "plastic" character, are susceptible to modification and change. In this way acquired knowledge, that may be handed on by tradition, is developed (Popper,1983:97,98).

It is in this sense that Popper speaks of all observation as theory-impregnated. By "theory" in this connection he does not refer to a linguistic formulation but to the network of dispositional anticipations that the organism brings to the observation of any situation. We always approach the object world with a certain set of expectations, initially inborn and subsequently modified by experience, but with the inborn component always predominating (Popper,1979:71,72).

All knowledge, then, as knowledge possessed by a subject, is dispositional, whether as original inborn dispositions or as modifications of those inborn dispositions acquired in the process of adjusting to the environment. In this dispositional knowledge all knowledge, including the objective knowledge of "World 3" with its subject-independent autonomy, originates (Popper,1979:73,74,116,147). We may call this dispositional, subjective or organismic (Popper,1979:73) knowledge,

original knowledge, since in it all knowledge originates.

This original knowledge is not generated by the rationality of the subject, but is entirely conjectual, a set of guesses. All empirical content of knowledge is, at any level, therefore, nothing but a set of guesses; "we cannot hope or expect to have more than conjectural knowledge". There are no secure rational formulations or starting points for knowledge; all knowledge is "built on sand" (Popper,1979:vii,9-11, 33,34,104,105; 1983:102). A large part of Popper's arguments are directed at exposing what he regards as the mythology of the rational origins or foundations of scientific knowledge.

In the final analysis all knowledge has extra-rational origins either in inherited biological dispositions or in the creative imagination that modifies these dispositions in experience. The modification of dispositions, or creation of new theories, on which the growth of knowledge depends, is not a rational reconstruction but a creative guess, a boldly imaginative conjecture, for which no rational or logical prescription is possible. This is not to say that it is a "wild" guess that disregards all existing knowledge and all rational considerations. It takes place within an epistemic tradition and a context of rationality but the construction of the new theory is governed neither by this tradition nor by this rationality. It is a wholly free, intuitive act of the subject's imagination (Popper,1980:14,31, 32; 1983:xxxv).

Yet, although he discusses it at length, Popper regards this extra-rational formation of knowledge as outside the scope of epistemology. It serves only as the epistemological background. In this background he includes metaphysical theories understood as non-testable (Popper, 1983:80-82). Epistemology is concerned with rational knowledge which on Popper's theory is equated with scientific knowledge.

In one respect Popper's position is continuous with the rationalist

tradition in which he sees himself but in another important respect it represents a break with that tradition. It is continuous in that epistemology is concerned in that tradition as in Popper with knowledge as a rationally governed feature of human experience. In the tradition, however, this goes hand in hand with the view that all knowledge is from first to last rationally governed. Popper makes a most significant break with the tradition, therefore, in distinguishing between a primitive and formative level of knowledge governed by extra-rational factors and a rational level of knowledge to which he restricts epistemology properly speaking.

Rational knowledge, the concern of epistemology, begins for Popper from the moment that dispositional knowledge is given a linguistic formulation with a view to critical testing. This means, in the first instance, that the formulation must have a logical structure such that the stated theory is falsifiable. This is the crucial demarcation criterion of science. Science, of course, involves more than the formulation of falsifiable theories; it must proceed to apply systematic logical and empirical tests in an attempt to refute the theories. Nevertheless the critical borderline is the systematic formulation of theories with a falsifiable logical structure (Popper,1980:98-100).

This is not denied by Popper's assertion that the logical form of a statement is not sufficient to determine its testability (Popper,1983: 195). As he makes immediately clear, his intention in this connection was to distinguish his position from the correspondence rules of logical positivism. The logical positivist program looked for a definitive logical structure to distinguish scientific theories under all circumstances. While Popper maintains that scientific theories are distinguished by a falsifiable logical structure he insists that this logical criterion of falsifiability is always relative to the total epistemic context. We cannot determine the falsifiability, or testa-

bility, of a theory by examining its internal logical structure in isolation but only in relation to the epistemic context at any given time. However, this relativity does not change the basic position that falsifiability as a demarcation criterion for scientific knowledge is a criterion attaching to the logical structure of theories.

The extra-rational is not eliminated from this rational (scientific) knowledge but it is brought under rational controls. Theories remain conjectures, creative guesses rather than rational reconstructions, but are subject to the rational control that they be formulated with a falsifiable logical structure. Scientific knowledge is then subject to the further rational control that, in place of the hit or miss process of error elimination that operates at other levels of knowledge, scientific theories are subjected to systematic error elinination procedures (Popper,1979:24,25; 1980:78-92; 1983:xix-xxv,159-189).

It is in this context that we are to understand Popper's assertion that he does not "believe in belief" (Popper,1979:25; 1983:21). It is apparent that he does not mean to deny either the existence of beliefs or their epistemic relevance. The very form of his assertion as an assertion of disbelief attests to his recognition that belief has a place in human experience. Besides he does not hesitate to state his own epistemically relevant beliefs and to use the terminology of belief in relation to dispositional knowledge (Popper,1983:7,80,101, 102,156,157).

What he is asserting in disclaiming belief in belief is that the analysis of belief has no epistemological value. The very nature of the rational knowledge that is the object of epistemology is that it transcends belief by the way in which it formulates its theories. This does not raise them from opinion to certitude but from the level of belief to rational criticisability. By the systematic use of rational criticism we transcend ourselves, our theories and beliefs, though in

transcending our theories or beliefs we must always replace them with new theories (Popper,1979:6; 1983:154-156). Since beliefs as such have no function in rational knowledge but only as they are translated into criticisable theories - though they have a place in the background to such knowledge - the analysis of belief can have no relevance for epistemology which, by definition, is the analysis of the logic of rational knowledge, in which beliefs have become objectively criticisable theories.

In short, while Popper recognises extra-rational factors as background, even indispensable background, for his epistemology, he maintains that they have no role in epistemology as such. They are worth studying but their study can only be an empirical science or metaphysical background, not epistemology which is the analysis of the logic of knowledge. Since the logic of knowledge is embodied in the logical structures of the statements of scientific knowledge with their logical connections and relationships it is the analysis of these logical structures that must be the concern of epistemology.

In contrast to Logical Positivism, however, Popper does not look for any definitive logical model of scientific statements. His epistemology is not concerned with ideal models but with the logical structure of the actual statements of science with all their existential relativity (Popper,1980:13-22,97-100; 1983:96,97,174-177). It is perhaps this feature of his epistemology that has endeared him so widely to practising scientists.

3.3.3 The Extra-Rational as Epistemic Governing Principle

Polanyi, as much as Piaget and Popper, wishes to maintain the rational character of knowledge. He has no wish to surrender knowledge to a blind irrationality but is at pains to detail the indispensable rational qualities of knowledge, and particularly scientific knowledge. However, in a decisive break with the rationalist tradition he denies

any autonomous, self-authenticating structure to rationality. Rationality, he insists, is rooted in the extra-rational as fiduciary commitment (Polanyi,1962:297-298).

Rationality is reduced from the status of epistemic governing principle to that of a property of cognition. The governing principle of knowledge is the subject's personal commitment. Knowledge in its objectivity is an intellectual fiduciary commitment and the rationality of knowledge can be served only within the fiduciary framework of a self-authenticating personal commitment (Polanyi,1962:viii,59-62, 294-298).

It is beyond the scope of the present discussion to examine all the intricate detail in which Polanyi elaborated his theory. We must be content to sketch some highlights that will illustrate some relationships and contrasts with other positions in connection with the theme of the present discussion.

Polanyi claims that all knowledge is an act that is either tacit or rooted in tacit knowledge. The articulate knowledge of science is not a transcendence of inarticulate animal knowledge but is a partial articulation of knowledge that always has an indispensable tacit coefficient. What is articulated is never anything but the tip of the iceberg of our knowledge. Consequently "we remain ever unable to say all that we know" and in what we do say "we can never quite know what is implied in what we say" (Polanyi,1962:95; 1969:194,195).

It is in the employment of language that human knowledge is distinguished from and given decisive intellectual superiority over the merely animal knowledge with which it is continuous. Yet these linguistic powers do not allow us to transcend the tacit since they remain dependent on the inarticulate which they can never articulate other than partially. In the final analysis what distinguishes the human is not language but the tacit conceptual faculty that, although

it is dependent on language for its functioning, always comprises more than language can articulate. It is the conceptual faculty of thought, and not the language that (partially) articulates it, that is primary (Polanyi,1962:69-71,87-102).

Given this analysis of knowledge it is clear that epistemology cannot be concerned with the analysis of knowledge statements since these are only the secondary products of a partially-articulated knowledge. Knowledge, in its primary and complete sense, is an activity of the subject having the character of a skilful art (Polanyi,1962: vii,62-65,132). Unless it is to shoot wide of the mark, then, epistemology must analyse this activity of the subject.

In his analysis Polanyi concludes that the governing principle of this activity is the personal commitment of the subject. The self-authenticating, autonomous rationality of rationalism is decisively displaced by a self-authenticating, autonomous personal commitment (Polanyi,1962:viii,299-324,397).

Epistemology, then, becomes the analysis of the structure of commitment. Commitment is not reducible to any single faculty or typical act but is an engagement of the whole subject in the epistemic enterprise. Consequently Polanyi's analysis covers a wide range of personal qualities, activities and relationships in exploring the structure of commitment. However, at the core of commitment is a structure of beliefs; our commitments accredit beliefs as the foundations of all our knowledge providing us with the fiduciary framework outside which intelligence is incapable of operating (Polanyi,1962:264-268,313).

This has far-reaching epistemological consequences. The rationalist tradition did not always agree on the exact nature of the relation between knowledge and belief but it did agree on the imperative of the critical evaluation of beliefs by rational criteria. Polanyi insists that beliefs, held acritically and even dogmatically, constitute the

foundations and ultimate source of all knowledge. Science, in the final analysis, is "a system of beliefs to which we are committed". The growth of knowledge requires not the transcendence of belief but the confession and articulation of our beliefs. Criticism retains a place but no longer in the rationalist sense of the criticism of belief.. The rationalist way of critical doubt is a fraud; only the dogmatism that conquers self-doubt in the deliberate holding and declaration of unproven beliefs is true to the epistemic reality (Polanyi,1962:171,264-268,297-298).

Polanyi's answer to those who recoil from such open advocacy of dogmatism is to say that he is not prescribing dogmatism as a normative proposal on which we can act or not as we will but is presenting an analysis of a universal state of affairs; all knowing, as a matter of fact, is founded in unproven beliefs. His normative proposal is that we recognise this state of affairs in our epistemology by a frank declaration of these unproven beliefs rather than hiding them behind the deceptive creeds of rationalism; "a dogmatic orthodoxy can be kept in check both internally and externally, while a creed inverted into a science is both blind and deceptive" (Polanyi,1962:268).

Again, while not always agreeing on the identity of the criteria, the long rationalist tradition including the predecessors of modern rationalism in the Greek/Hellenistic tradition had agreed in assuming that there are universal intersubjective criteria for evaluating knowledge claims. Polanyi abolishes all such criteria. Any intersubjective value that a particular set of criteria may have can only be due to the accident of an intersubjective sharing of commitments. There is no source of evaluative criteria outside the personal subject that legislates for itself within the fiduciary framework of its own commitment (Polanyi,1962:264-268,308-324).

Viewed from the standpoint of rationalism this could only leave us

drifting on a shoreless sea of subjectivism. Even worse, it would leave us each individually drifting alone brought together if at all only by the accidents of history. Polanyi, however, argues that the structure of commitment itself prevents any such subjectivist disaster, providing, on the contrary, the "only path for approaching the universally valid" which the objectivism of rationalism deceptively claims to attain by its delusive ideal of objectivity (Polanyi,1962: 303,324).

The structure of commitment has two poles, a personal pole and an impersonal or universal pole. Commitment is personal in that it is a commitment of a personal subject. It is impersonal in that it is always a commitment to a universal that transcends the personal. As a personal engagement of the subject commitment always has universal intent as the object of this engagement. These two poles are correlative; one cannot exist without the other. Hence, wherever there is commitment the subject is committed to the transcending of subjectivity in the attainment of universal standards (Polanyi,1962:65,308-313, 323,324,336,396,397).

It should be noted that this universal structure of commitment leaves wholly indeterminate the content of the beliefs that are constitutive of knowledge. The structure of commitment ensures that the committed person acts responsibly, not as he pleases but as he must with universal intent within the terms of his commitment but the content of the obligations that constrain him in this responsible action are such as he lays down for himself by himself. The universal standards that form the impersonal pole of commitment are the subject's self-set standards (Polanyi,1962:63,308-312,396-397).

Polanyi's position is a direct inversion of rationalism. On the rationalist position beliefs have a legitimate place in knowledge only as rational beliefs, beliefs that pass the critical tests of a self-

authenticating rationality that is the source of our knowledge. Polanyi's position is that rationality has a legitimate function only in the service of the unproven beliefs that are the source of our knowledge.

3.3.4 A Comparative Summary

With regard to the epistemic relation of rational and extra-rational there is a gulf between Piaget and Popper on the one hand and Polanyi on the other. The first two, following in the rationalist tradition, give cognitive primacy to a self-autheticating rationality whereas Polanyi subordinates rationality to a self-authenticating fiduciary commitment.

All three regard human knowledge as continuous with animal knowledge but draw widely differing conclusions from the connection. Piaget finds in it a continuity of rationality, the governing rationality of human knowledge being a higher level development of the biological rationality that is the governing principle of the most primitive organism. Popper, on the contrary, sees it as necessary to introduce a discontinuity within the human in order to secure the rationality of the higher levels of human knowledge; only with the introduction of language is it possible for a rational governing principle to be introduced into knowledge allowing humaness to transcend a primitive irrationality in the critical rationality of objective knowledge.

It may be recalled that the semiotic function, of which language is one manifestation, also marks an important boundary in the Piagetian scheme. It is not, however, as language is with Popper, the boundary between the irrational, or pre-rational, and the rational but between animal rationality and human rationality.

Polanyi agrees with Popper on the fundamental irrationality of animal knowledge - taking "irrational" to mean having an extra-rational governing principle - but differs in insisting on unbroken conti-

nuity with the highest levels of human knowledge. Whereas Popper argues that language opens the door to rationally governed knowledge discontinuous with the lower levels of knowledge in its governing principle Polanyi contends that language extends the primitive cognitive powers of the organism, operating on the same extra-rational governing principle, to the highest levels of human knowledge.

Piaget and Polanyi agree on the unbroken continuity of knowledge from the most primitive organism to the highest levels of human knowledge. They differ with regard to the governing principle of this epistemic continuity. Popper agrees with Polanyi, dissenting therefore from Piaget, that the governing principle of animal knowledge is extra-rational but argues that this only forms the sub-structure for the highest levels of human knowledge where a rational govering principle prevails over the extra-rational.

In short, Piaget maintains that the knowing subject at all levels, from the primitive organism to the highest levels of scientific thought, is a rationally governed subject. Polanyi maintains that the knowing subject at all levels is governed by the extra-rational principle of commitment. Popper maintains that in science the knowing subject transcends a primitive irrationality to become a rationally governed, critical subject.

Finally, Popper sees the knowing subject in the limited role of rational critic governed by a universal rationality unfettered by the extra-rational background. Piaget, on the other hand, while maintaining that a universal rationality governs the cognitive mechanisms of the knowing subject at all times, recognises extra-rational constraints that limit the field of operation of those mechanisms. Polanyi maintains that the knowing subject can function freely and truly only as all pretence at rational control is abandoned and the subject frankly acknowledges the extra-rational sources of knowledge.

3.4 CONSTRAINTS EXTERNAL TO THE KNOWING SUBJECT

3.4.1 Reality as the Transformational Content of Knowledge

While the primary concern of Piaget's work was always the cognitive activity of the subject as constructive activity, he clearly recognised that this activity is constrained in important respects by the subject-independent reality of the objects of empirical knowledge.

There exist material objects with intrinsic and inalienable properties independent of the subject of which the knowing subject must take account as the objects of empirical knowledge. An essential component of empirical knowledge is the empirical abstraction by which the subject abstracts these intrinsic properties from the coherence of the perceptual experience. These material properties are not simply read off by the subject from primitive sensations but are abstracted with the aid of cognitive instruments constructed by the subject. They are not imposed on the objects by the subject but rather are imposed on the subject by the material objects (Piaget,1977:5,6; 1979:10,109; 1983b:173).

Yet knowing is not merely apprehending material reality in its givenness. It is a constructive activity that enriches and transforms material reality as it is differentiated in multiple possibilities actualised within a framework of deductive necessity. Neither the possibilities nor the necessity are given in material reality but are generated by the subject's cognitive activity (Piaget,1981:181-188; 1983:5-8,163-173).

In an important sense, then, the further knowledge progresses the further it is removed from material objects <u>in their primitive givenness</u>. Material reality becomes an enriched, transformed reality, its objects acquiring attributed properties in addition to the original intrinsic properties and its original undifferentiated perceptual unity giving way to a richly differentiated unity of deductive neces-

sity.

Nevertheless, throughout all this transformation the material objects remain a subject-independent reality with unchanging intrinsic properties. As subject-independent, transformational object, material reality functions as the cognitive "limit", that which the knowing subject aims to attain but which, owing to the inexhaustible richness of its transformational potential, can only ever be known in successive approximations (Piaget,1966-7:16; 1977:5,6; 1979:10; 1983:173).

Thus in Piagetian epistemology material reality, not as a static order but as transformational, subject-independent object of empirical knowledge, constrains the constructive activity of the knowing subject.

3.4.2 The Objective World of Theories

Popper regards himself as a metaphysical realist and his epistemology as based on metaphysical realism (Popper,1983:xxv,149). He also holds a correspondence theory of truth as "agreement with the facts of what is being asserted" together with an absolutist view of truth (Popper, 1979:44-46; 1983:xxxi,26).

While this is all important background to his epistemology, within that epistemology it is not material reality or absolute truth that functions as external constraint on the knowing subject but the objective world of theories, problem statements and other lingual entities. Popper used the term "third world" and later, following a suggestion of Sir John Eccles, "World 3", to distinguish this domain of theoretical entities from the domain of material reality (World 1) and the domain of subjective experience (World 2) (Popper,1979:vii,73,74,106-190).

There is, as Popper acknowledges, a strong likeness between this autonomous world of theories and the Platonic Ideas (Popper,1979:106,