

**Aquinas and the Realist Dispute in Science**

**An Aristotelio-Thomistic contribution to current discussions in  
language, logic and science**

by

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## Abstract

The particular issue in the philosophy of science I propose to treat along Thomistic lines is the realism vs. anti-realism debate, or what I will call the realist dispute in science. The dispute centres on the precise interpretation that should be given to scientific theories in general. Closely associated with this dispute is that regarding the widely divergent understandings of the nature and aims of the scientific enterprise as a whole. In the past participants in this discussion have tended to champion either a form of realism or a form of anti-realism. I reject this traditional either/or, convinced that neither position can do justice to all scientific theories. I show that both positions have some merit and that a melding of the two into one coherent position is necessary. This project of synthesising an inclusive position out of two more narrow views is made easier if one is acquainted with Thomas Aquinas' philosophy of science.

Part I is entirely devoted to current issues in the philosophy of language, logic and science. The burden of the *Introduction* is to familiarise ourselves with the strengths and weaknesses of scientific realism and scientific anti-realism, and to show that a synthesis of realist and anti-realist tendencies is desirable. Chapters Two and Three deal with a challenge stemming from semantic anti-realists concerning the proper understanding of the nature of truth. The remainder of Part I is devoted to the problem of demarcation. In Chapter 6, which deals with Quine's thesis concerning the indeterminacy of radical translation, I offer a method of distinguishing areas of discourse capable of bearing a realist interpretation from those demanding treatment along anti-realistic lines.

Part II begins our study of Aquinas' philosophy of science. Aquinas is presented as offering an intellectual system consistent with conclusions drawn in Part I. Moreover, his attempt to make theology a science on the Aristotelian model is seen to be analogous to our attempt to reconcile realist and anti-realist tendencies in the realist dispute in science.

In Part III I return to issues raised in the *Introduction* to Part I, and show how the inclusive position developed in Parts I and II can be used to treat two modern scientific theories, Darwin's theory of Natural Selection and Newton's Laws of Motion and Gravity.

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## Preface and Acknowledgements

The natural sciences in the twentieth century have become to philosophers and society generally what theology was to the scholastics. Previously it was embarrassing for a philosopher to be in conflict with orthodox theology. Now philosophers working in areas connected to the sciences ignore the Church and keep a watchful eye on the received scientific theories of the day in order to avoid being in conflict with current orthodoxy. This is as it should be. The Church has no claim on the philosopher, and philosophers quite properly defer to scientists on scientific matters.

But it is precisely because the natural sciences enjoy such prestige that its aims, function and limitations must be clearly understood. However, when we turn our attention to these matters, and make inquiries concerning the cognitive status of scientific theories, we cannot expect authoritative answers from the scientist *qua* scientist, for these are not scientific questions. In point of fact, our views on these specifically philosophical, or meta-scientific matters determine how we interpret the dictates of the scientist. But as any casual survey of the available literature will show, no single philosophy of science addressing these issues has been able to command the assent of all interested parties. This lack of consensus may or may not be inherently unsatisfactory in itself. Yet despite the fact that no consensus has emerged, appeals to science are constantly made, both in academic circles and in the public arena at large, without any acknowledgement that these appeals are in any way problematic. This unsophisticated use of science is philosophically intolerable, and is arguably more serious than our ignorance of the latest scientific theories and discoveries. Indeed, our woeful scientific illiteracy is never more in evidence than when we confidently defer to authority of scientists while failing to understanding the cognitive status of the theories they have produced.

It is with these thoughts in mind that the following study has been undertaken. It seems to me that a hermeneutics of scientific theories is needed, and one with the possibility of attracting widespread assent. But if one wishes to engage in current debates in the philosophy of science, a degree of surprise is to be expected if it is stated overtly that one's principal source of inspiration in these matters is the work of a thirteenth century Dominican monk and leading figure of a *dépassé*

authoritarian institution. For despite the fact that we are now living in what is vaguely called a "post-modern" age, we remain enamoured by the idea of progress, both intellectual and social. It is therefore not surprising that to contemporary thinkers concerned with things scientific the mention of Thomas Aquinas will appear retrograde in the extreme. His religious affiliations aside, Aquinas had no knowledge of modern science, nor was he privy to our latest intellectual achievements. It is therefore quite reasonable in today's intellectual climate to doubt that Aquinas has any contribution to make to debates in twentieth century philosophy of science. In fact it is only if Aquinas is seen against the background of modern debates in the philosophy of science, logic and language that the modern philosopher is likely to be able to appreciate Aquinas' potential contribution. And I believe that it will be only too apparent why Aquinas deserves our attention once the results of a series of investigations into these matters have been made clear. It is for this reason that a work ostensibly inspired by and about the work of Aquinas must devote much space to the work of modern thinkers.

The particular issue in the philosophy of science I propose eventually to treat along Thomistic lines is the realism vs. anti-realism debate, or what I will call the realist dispute in science. Some space will be devoted to the characterisation of these positions and the particular points of dispute. These terms are not being used here in any idiosyncratic fashion, but for now let it suffice to say that the disagreement centres on the precise interpretation that should be given to scientific theories in general. Closely associated with this dispute is that regarding the widely divergent understandings of the nature and aims of the scientific enterprise as a whole.

The modern debate starts most clearly at the end of the nineteenth century when the common sense realism of most philosophers of science was challenged by the replacement of the classical physics of Newton by the new physics of Einstein. Developments in Quantum Mechanics have only exacerbated matters. Work in the anti-realist vein furthered by such writers as Mach, Poincaré, Duhem, Eddington, and most recently by Bas van Fraassen and Nancy Cartwright gains a hearing among those whose confidence in common sense realism has

been shaken. Anti-realism in science also appears to receive support from Thomas Kuhn and other historians of science. It would be absurd to suggest that all these writers agree on the nature of science in all details; but as Ian Hacking has pointed out in *Representing and Intervening*, scientific realism and scientific anti-realism are positions more correctly characterised by their general attitudes rather than by particular points of doctrine.<sup>1</sup> It is therefore quite proper that they be grouped together at least in terms of this particular debate.

It would be a colossal task indeed to consider each of these thinkers in turn, taking time to analyse the merits of each position and the realist responses. Thankfully this is not what I propose. The reason for refusing this type of approach is that it is misguided. Past realism vs. anti-realism debates have been conducted along the lines of a rigid either/or, although Cartwright and Harré are notable exceptions.<sup>2</sup> Parties to this dispute have traditionally been strongly in favour of one position or the other. I reject this traditional either/or because I am convinced that neither position is entirely satisfactory on its own. However, the fact that this debate has been with us intermittently since at least the days of the ancient Greeks<sup>3</sup>, coupled with the fact that both sides in this dispute can claim the allegiance of scientific luminaries and respected philosophers, suggests that both sides in the dispute have some valuable contribution to offer to the philosophy of science. It seems reasonable, therefore, to suggest a different line of enquiry. Although the role of mediator is notoriously an uncomfortable one, we should not be deterred from attempting to do justice to both positions by combining their respective strengths into one coherent position in the realist dispute in science. I intend to show that this project of synthesis is both desirable and manageable *before* entering into any detailed considerations of Aquinas' philosophy of science. As intimated earlier, arriving at such a position requires acquaintance with much twentieth century thought in the philosophy of science, logic and language. The work of Duhem, van Fraassen, Quine, Putnam and Dummett in particular will be front and centre.

Our first task is to focus on the particular strengths and deficiencies of both scientific realism and scientific anti-realism. This involves perusing the old debates where the traditional problems with both positions have surfaced. What emerges from this study is that neither



position is entirely satisfactory as it stands, but that each contains something of value.

The second problem demanding attention is a particular argument emerging from comparatively recent debates in the philosophy of language. Problems in the theory of meaning, reference and truth associated most closely with the likes of Quine, Putnam and Dummett will occupy us here. The argument in question, forwarded by semantic anti-realists, invites the conclusion that any view of scientific theories is bound to be incoherent and untenable if it is wedded to the view that truth is properly understood to be a possibly verification transcendent property of sentences. Since scientific realism and scientific anti-realism (in the form they will be given here) are both open to this allegation, some common defence must be offered.

The third difficulty to be faced before attention can be paid to Aquinas is the problem of demarcation. Given my intention to combine realism and anti-realism into one coherent position, some means of distinguishing that area of discourse about which we take a realist attitude from that demanding an anti-realist approach is required. It might be expected that help in this area would be forthcoming from scientific anti-realists who are not anti-realists with respect to every area of discourse. Unfortunately no satisfactory solution can be found in their writings. However, discussions in the philosophy of language provide an indication of how this demarcation problem can be resolved.

A disproportionate amount of space will be devoted to the conservation of scientific realism since it is the more difficult of the two positions to defend. But as is often the case in philosophy, it is the seemingly obvious position that proves difficult to maintain while the counter-intuitive position forces itself upon us even against our wishes. In this study we will be confronted with two counter-intuitive conclusions: First, that we must go to extraordinary lengths to save a form of scientific realism; second, and perhaps even more odd, that a thirteenth century Dominican monk will help us in this endeavour.

This thesis falls into three sections, Part I being entirely devoted to the work of twentieth century thinkers, Part II to an analysis of Aquinas' philosophy of science, and Part III to the presentation of conclusions. I

would like to thank Professor J.E. Edwards for his invaluable supervision, particularly with respect to Part I, and Professor Alexander Broadie, who offered similar assistance with respect to Part II. I would also like to thank Dr Christopher Martin for supervising my research as a whole during the first two years. And finally I would like to thank the Administrators of the *Overseas Research Students Awards Scheme* for a grant in aid.

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<sup>1</sup> Hacking, I. *Representing and Intervening: Introductory Topics in the Philosophy of Natural Science*. Cambridge: Cambridge University Press, 1992, p. 26.

<sup>2</sup> The following passage from *The Philosophies of Science* illustrates Harré's willingness to forego the traditional either/or. He writes: "If mechanics with its eliminable concept of 'force' provides a model for phenomenologists (anti-realists), the virus theory of disease provides a counter-model for realists. Science, it seems, contains both kinds of theory. . . . We shall recognise many kinds of theory, from the wholly phenomenal to the wholly realistic." Unfortunately in the same paragraph Harré says that "The resolution of this confrontation is beyond the scope of this book." Oxford: Oxford University Press, 1972, p. 92.

<sup>3</sup> See Duhem's *Le Système du Monde*, Volume 2, *Histoire Des Doctrines Cosmologiques de Platon à Copernic*. Paris: F. De Nobele Libraire, 1955. See Ch. 10 in particular for a discussion of the history of the debate concerning the representation of the movements of the wandering stars.

## **Part I**

### **Chapter 1**

#### ***An Introduction to the Realist Dispute in Science***

Let us adopt the phrase 'the realist dispute in science' as a convenient label for all the arguments and issues raised in the ongoing debate between scientific realists and scientific anti-realists. At the heart of this dispute is the disagreement concerning the manner in which scientific theories are to be interpreted. Are mature scientific theories to be taken as accurate representations of the world, as the realists maintain? Or are the anti-realists right to insist that mature theories are not to be taken literally? Can it be that mature theories are 'merely' intellectual instruments which facilitate the inference of observation statements from other observation statements? It is this question concerning the cognitive status of mature scientific theories which most clearly divides the realists from the anti-realists.<sup>1</sup> And one's response to this initial question naturally informs one's understanding of scientific activity in general.<sup>2</sup>

In this opening chapter we will outline the central claims of both scientific realism and scientific anti-realism, as well as the major objections which have been brought against them. But as mentioned in the *Preface*, I have no intention of joining this debate as a proponent of either side. It is my view that both interpretative traditions have their merits and their deficiencies. Consequently, the purpose of this chapter is not to give the laurel to either side, but simply to familiarise ourselves with the issues at the heart of this dispute. To get our intellectual bearings, as it were, it is best to begin with an examination of scientific realism.

#### ***'Naive' Scientific Realism***

In a wonderfully frank and succinct passage Charles Peirce manages to state the central doctrines of scientific realism and at the same time to convey a sense of its intellectual 'flavour' or spirit. After having

considered a number of methods human beings have employed in the pursuit of knowledge (or as he would prefer, in our attempt to relieve the 'irritation of doubt') he writes that:

It is necessary that a method should be found by which our beliefs may be determined by nothing human, but by some external permanency - by something upon which our thinking has no effect. . . . It must be something which affects, or might affect every man. And though these affections are necessarily as various as are individual conditions, yet the method must be such that the ultimate conclusion of every man shall be the same. Such is the method of science. Its fundamental hypothesis, restated in more familiar language, is this: There are Real [sic] things, whose characters are entirely independent of our opinions about them; those Reals affect our senses according to regular laws, and, though our sensations are as different as are our relations to the objects, yet, by taking advantage of the laws of perception, we can ascertain by reasoning how things really and truly are; and any man, if he have sufficient experience and he reason enough about it, will be led to the one True [sic] conclusion. The new conception here involved is that of Reality [sic].<sup>3</sup>

There are a number of specific claims in this passage which need to be drawn out explicitly. Some are clearly stated; other equally interesting claims are hinted at or there by implication. Some of these claims are no doubt crucial to any form of scientific realism; others might arguably have the flavour of scientific realism without commanding the assent of all scientific realists. But as Hacking has judiciously pointed out in *Representing and Intervening*, the two interpretative traditions we will be considering express or embody a general attitude or approach to science, not simply a list of doctrines.<sup>4</sup> Consequently it is important to stress that scientific realists need not accept *all* of the following theses. With these qualifications in mind one can say that scientific realism is typically characterised in the literature by the following claims:

a) *The world* (Peirce's 'external permanency') *exists independently of our representation of it.* In Peirce's terminology, there is something upon which our thinking has no effect and which exists before we come to

know it in any way. We can refer to this thesis as 'ontological realism'.

b) *All human beings in full possession of their cognitive faculties are capable of ascertaining the nature of this independently existing world.* We can refer to this thesis as 'epistemological realism'.

c) *Human beings become familiar with the world principally by means of the senses.* This can be taken to be a commitment to some form of empiricism. The role of creative imagination is not denied an important place in the scientific method, being indispensable to the development of new scientific hypotheses. But the senses remain the touchstone of the scientist insofar as no product of the creative imagination is acceptable as it stands if it is contradicted by observation.

d) *The ultimate aim of scientific activity in general is to discover the one true representation of the totality of facts about this independent world.* To employ a phrase of Peirce, science is the pursuit of that theory which tells us 'how things really and truly are.'

e) *The acceptance of a scientific theory is the acceptance of that theory as true, or 'approximately' true, where 'truth' is understood to be a possibly verification transcendent property of sentences.* This latter phrase implies two distinct claims: first, a sentence is said to be true or false in virtue of states of affairs in the world; second, a sentence may be true or false without our being able to establish its actual truth value. Moreover, acceptance of a theory as true implies an ontological commitment to the entities named by the terms in the theory.

f) *When this one true theory is discovered it will command assent from all competent human beings.* A person is said to be 'competent' in this context if he or she, i) is in full possession of their cognitive faculties, ii) has complete access to all the relevant data, iii) has diligently applied themselves to this data, and iv) delivers a sincere verdict on the basis of the available evidence. Competence entails a combination of material conditions in addition to intellectual and moral virtues or characteristics.

g) Accompanying theses a-f one usually finds a compatible view of the nature of scientific progress. The traditional view which is most in agreement with the general tone struck by scientific realism has two features worth distinguishing. First, the history of science is presented as the history of our progressing towards the one true theory, each theory on the way being an ever closer and closer approximation of the truth. Progress is usually made through a process of 'reduction' or 'convergence'. A theory (T1) is 'reduced' when a successor theory (T2) in some sense *incorporates* or *conserves* the truths discovered by (T1) while avoiding its errors and adding new information. (T1) is usually seen as a special case recognised by (T2). Convergence, on the other hand, occurs when two or more disparate lines of investigation appear to reach similar conclusions.<sup>5</sup> The second feature of this theory of scientific progress is the claim that when the scientific community decides to replace a previously accepted theory by another, this is achieved by the application of methodological rules and standards accepted by the community as a whole. (Usually the rules governing the replacement of one theory by another have largely to do with the process of 'falsification'.) The point to emphasise is that the replacement of one theory by another is not achieved on the basis of the idiosyncratic tendencies of any one individual or group of individuals, but on the basis of standards accepted by the scientific community as a whole.

Many scientific realists will blush after perusing this list of theses, or perhaps hotly deny that he or she is committed to any number of them. Indeed when these claims are set out this starkly one gets the unavoidable impression of naive, if noble, optimism. But they have not always seemed so naive. Peirce was certainly not unfamiliar with scientific practice and thought when writing this passage in his famous essay. Indeed, part of the usefulness of Peirce's description of science is that the real spirit of scientific realism comes through in all its unabashed sincerity. Scientific realists nowadays put forward their claims with much greater circumspection (as we shall see); but I would hazard the guess that the spirit expressed in the above passage still quickens their blood. Nevertheless, the history of the philosophy of

science in our century might reasonably be described as a continual falling away from this simplest and perhaps most natural of interpretative traditions. Of course, this realist picture of science has been challenged at various times throughout history, either in its entirety, or in bits and pieces which can stand or fall on their own. But certainly in our own time it has become increasingly difficult to defend these theses *en masse*, theses d - g being particularly vulnerable to attack. The most pressing objections are now common places in the literature. Nevertheless, it is still worth our while to have them clearly before us.

### *Problems of Consistent Interpretation*

Perhaps the most basic problem facing the scientific realist is that scientific theories and statements often contradict other scientific theories and statements when taken realistically. For example, it is not uncommon for there to be two conflicting theories of one and the same phenomenon. A good example of this problem is found in the conflicting descriptions of the nature of light. It is said that light behaves sometimes like a wave, and sometimes like a particle. Now, in practice the scientist tends to employ the description best suited to the particular circumstances he is faced with, without committing himself exclusively to one view or the other. But it is difficult for the realist to reconcile these descriptions of light if the terms 'wave' and 'particle' are taken literally, i.e., according to the original or focal sense of these terms. 'Wave' and 'particle' when taken in their focal sense refer to ontologically distinct entities: waves occur in a medium, and are inseparable from that medium; particles, on the other hand, are discrete bodies, or quantities of energy. It seems reasonable enough to assume, goes the objection, that if the terms 'wave' and 'particle' are to be taken literally, then light can be either a wave or a particle, but not both at once, nor 'wave-like' at one moment and 'particle-like' the next. But if the terms are taken only metaphorically, then it is far from evident that they can bear a realist interpretation.<sup>6</sup>

But more serious and thorough-going contradictions exist between the

two principle theories in physics, namely relativity and quantum mechanics. As we know, quantum mechanics has proved highly successful dealing with phenomena at the micro level, while the theory of relativity has enjoyed similar success at the macro level; yet the pictures they present of the natural world are notoriously difficult to reconcile. One difficulty for those trying to combine relativity and quantum mechanics is discussed by Smolin in his article 'What is Time?'. He focuses on the incompatible notions of time employed by these two theories. It is worth quoting an extended passage to get a sense of the difficulties involved:

. . . in theoretical physics, we have at present not one theory of nature but two theories: relativity and quantum mechanics, and they are based on two different notions of time. The key problem of theoretical physics at the present moment is to combine general relativity and quantum mechanics into one single theory of nature that can finally replace the Newtonian theory overthrown at the beginning of the century. And indeed, the key obstacle to doing this is that the two theories describe the world in terms of different notions of time. . . . Unless one wants to go backward and base this unification on the old, Newtonian notion of time, it is clear that the problem is to bring the Leibnizian, relational notion of time into the quantum theory. This is, unfortunately, not so easy. The problem is that quantum mechanics allows many different, and apparently contradictory, situations to exist simultaneously, as long as they exist in a kind of shadow or potential reality. . . . This applies to clocks as well, in the same way that a cat in quantum theory can exist in a state that is at the same time potentially living and potentially dead, a clock can exist in a state in which it is simultaneously running the usual way and running backward. So, if there were a quantum theory of time, it would have to deal not only with freedom to choose different physical clocks to measure time, but with the simultaneous existence, at least potentially, of many different clocks. The first, we have learned from Einstein how to do; the second has, so far, been too much for our imaginations.<sup>7</sup>

The particulars of this debate need not detain us. But what is clearly of importance to our realist dispute in science is the incompatibility (as yet) of two highly successful theories of nature.



A further example of the conflict at the heart of theoretical physics is worth mentioning since it brings out the conflict between relativity and quantum mechanics, as well as the conflict between quantum mechanics and basic assumptions of the scientific realist position. Mermin presents an nice account of certain experimental results discovered following reflections on a thought experiment of Einstein, Podolsky and Rosen.<sup>8</sup> To account for the behaviour of certain particles scientists were forced to postulate the existence of certain 'strange' causal connections between particles, connections deemed impossible by Einstein's Relativity theory (these processes seem to occur at speeds faster than the speed of light). But the interpretation of the results also falls afoul of the central thesis of ontological realism, i.e., that the Real does in fact exist independently of our representation of it. After consideration of certain peculiar experimental results Mermin concludes that:

[Certain] measurements, far from revealing the value of a preexisting property, had to be regarded as an inseparable part of the very attribute they were designed to measure. Properties of this kind have no independent reality outside the context of a specific experiment arranged to observe them: the moon is *not* there when nobody looks.<sup>9</sup>

These and other contradictions on their own cannot force realists to abandon scientific realism; for there is always the hope that they will prove to be merely apparent contradictions. Nevertheless, the realist cannot be surprised if the anti-realist does not share this optimism and refuses to wait for the realist to come good on what is little more than a promissory note. But the main point we need to draw out for our purposes is that it is unlikely that a realist interpretation of *all* scientific theories is feasible.

### *Defining Theoretical Terms*

Terms for observable entities, events and processes get their meaning (at least in part) by ostention. By drawing attention to an object within

a field of view, by pointing or gesturing, it is possible to fix the reference (if not the sense) of a term. For example, one can say, "This is an apple", while holding one up, or, "That is a tree", while pointing at one. This method of fixing the reference of a term makes use of a combination of verbal and non-verbal signals, and, crucially, ties the meaning of the term to an aspect of the real world, i.e. the real object referred to. Now it is clear that theoretical terms like 'mass', 'electron', 'gravitational field', etc., cannot be defined in this way: One cannot point to, or hold up an electron or a gravitational field. But the scientific realist claims that unobservable entities, events and processes named in scientific theories are just as real as observable entities. So how do theoretical terms get their meaning? And are these semantic accounts consistent with a realist interpretation of these terms? It is far from evident that we can answer the latter question in the affirmative.

A number of semantic theories have been forwarded to explain how theoretical terms get defined. Holists take the bull by the horns and claim that the meaning of a theoretical term is determined by the role it plays within the theory in which it is found. If one wants to know what the term 'mass' means in relativity theory, for example, one must look at the role the term is assigned in the various mathematical formulae in which it appears. On this view the meaning of a theoretical term is fixed by the theory in which the term is found, and not by reference to some extra-linguistic reality. In the semantic theories forwarded by the Logical Positivists and other reductionists, theoretical terms are still construed to be in some way about observable phenomena. The desire to remain true to strict empiricism forces them to adopt the project of translating all sentences containing terms referring to unobservable entities, events or processes into sentences containing no terms referring to such things. Russell considered theoretical terms to be logically equivalent to the data from which the existence of the theoretical entity was inferred. The set of data could then be substituted for the theoretical term in the original sentence, thereby eliminating the theoretical embarrassment but conserving its logical consequences. Bridgeman's project of reducing theoretical terms to operations performed with scientific instruments or formulae is another well known example of this attempt at reduction.

But both the holist and reductionist accounts conflict with a strong realist reading of theoretical terms, i.e., the view that these terms refer to entities, events or processes which actually exist in extra-linguistic reality. If theoretical terms like 'mass' or 'electron' get their meaning from their role as variables in mathematical equations, or from serving as a convenient short-hand symbol used to refer to a range of phenomena, or from particular operations a scientist performs with his paraphernalia, then the meaning of these terms shifts each time the equations employed, the phenomena referred to, or operations performed, change. But the extra-linguistic reality to which these terms allegedly refer presumably does not. Consequently it appears that the meaning of a theoretical term is fixed not so much in terms of some objective reality as it is in a set of human practices. It is more plausible, therefore, to see theoretical terms not as names for real things, but as theoretical constructs or intellectual tools.

The problem of providing a semantic account of theoretical terms which is consistent with a realist interpretation does not get any easier if one drops semantic holism or the commitment to explaining all theoretical terms in terms of observable phenomena. One might be tempted to say that the meaning of terms for unobservable entities, events and processes are derived from the meaning of terms used to refer to observable entities. On this reading the difference between theoretical terms and terms for observables is not that the latter are defined by ostention and the former are not, but simply that they refer to objects of significantly different scale. (Unobservable events and processes are said to be just like observable events and processes except that they are too small to be seen, or too far away, or moving too quickly or slowly, etc.) For example, the meaning of the theoretical term 'particle' could be gained by transferring a meaning associated with a term for an observable entity, say a solid body like a stone or billiard ball, onto the theoretical term 'particle'. So one might say that unobservable 'particles' are little solids which behave like little stones or billiard balls.

However, it is usually the case that certain properties of observable solids are not applicable to unobservable 'particles', and vice versa. To

continue with our example, observable solids are said to have secondary qualities like colour, texture, taste, etc., while these are denied to their unobservable counter-parts. This implies that the meaning of the terms for observables are not transferred onto unobservables with precisely the same meaning. This in turn suggests that the term is applied in one sense (the literal or focal sense) to observable solids, and in another (analogical or metaphorical) to unobservable solids. But if the term is used metaphorically in the context of scientific theory one is surely justified to question whether anything in extra-linguistic reality answers precisely to this term.

The reason for this suspicion is the following. There is nothing objectionable *per se* about the metaphorical use of a term. What is problematic is that the term will require clarification. How are we to interpret the metaphor? Just what features of the observable object on which the metaphorical sense is based are transferred onto the theoretical term, and which are not? If one is able to say that the theoretical term 'particle' shares precisely this set of features with observable solid bodies while excluding the remaining features which play no part in the theory itself, then the meaning of the term ought to be clear enough. But it is apparent already that the new meaning of the term is dependent upon the theory in which it is found. For the determining factors in the decision as to which features are transferred and which are not are the requirements of the theory in which the term is found. But this lands us back into the problem encountered in semantic holism and reductionism: The new meaning of the term is grounded not so much in an extra-linguistic reality as in a set of human practices. Consequently there is a tension at the heart of scientific realism: We may have an idea of how theoretical terms get defined, but there is no guarantee that there is any 'Real' corresponding to them.

### *The Blurring of the Theory/Observation Dichotomy*

Traditionally easy use has been made of the distinction in natural languages between observation sentences and sentences containing terms referring to theoretical entities. The assumption that this

distinction is unproblematic allowed scientists and realists to claim access to a 'theory-free' observation language, i.e., an objective standard, to which they could appeal in order to test scientific theories. Indeed, the crucial property of an observation sentence is that it is taken to be a member of that set of sentences in the language to which all competent language users in similar conditions would either assent or dissent together. This confidence in the objectivity of observation sentences or reports was based on the assumption that an extra-linguistic reality affects biologically similar entities in much the same way ('affecting our senses according to regular laws').

Yet it is now universally accepted that the theory/observation distinction is anything but unproblematic. What one observes appears to be largely dependent upon the theoretical assumptions and conceptual scheme of the observer.<sup>10</sup> This threat to the theory/observation dichotomy has led some to claim that the distinction has collapsed entirely, and that terms referring to observable entities are as 'theoretical' as those referring to atomic particles and force fields.<sup>11</sup> Others still insist that all human beings do 'see' much the same things, but that the interpretation placed on what is seen varies greatly depending on the conceptual scheme of the observer (the distinction between 'seeing' and 'seeing that').<sup>12</sup> In any case it is now common currency that no department of a natural language is totally 'theory-free': All language is 'theory-laden' or 'theory-infected'.

The collapse of this distinction can be taken two ways. If there is no clear cut distinction between terms for 'observable' entities and terms for 'theoretical' or 'unobservable' entities, then one may feel justified in extending one's realism to include the set of theoretical terms which previously had been in some doubt.<sup>13</sup> Conversely, one may judge it more prudent to see that all terms, observational or otherwise, come under a cloud of uncertainty formerly reserved for terms referring to 'theoretical' entities. This is not the place to decide which of these attitudes is the better. Nevertheless, a number of important points can be made which directly affect our particular dispute: If the theory/observation dichotomy is abandoned, then observation sentences can no longer be taken as an unproblematic standard by

which to test competing scientific theories. Observation sentences are 'just more theory', telling us more about the conceptual scheme of the observer than of the observed. A further consequence of the theory-ladenness of observation is that it is more than likely that the proponents of competing theories will interpret the results of experimentation differently. This rules out, or at least weakens, the possibility of finding 'crucial experiments' which can be run to decide conclusively between two competing theories. For an experiment to be 'crucial', i.e., for an experiment to be accepted as deciding between two theories once and for all, the proponents of the theories must agree on the interpretation of the experimental results. This agreement in turn will only be possible if there is already a significant over-lap (if not complete identity) of the conceptual schemes of the two proponents. If this agreement can be secured, then it is probable that the differences between the two competing theories are over matters of detail rather than fundamental principles. But if the two proponents differ as widely as, say, Galileo and the defenders of Ptolemy, the disagreement would be significant enough to preclude agreement on the results of the experiment.<sup>14</sup> Ironically, it is only when the proponents agree on the fundamentals that they can agree on the interpretation of the experimental results; while it is precisely when the proponents disagree on fundamentals that experimental evidence is impotent to move either to abandon their position in favour of the other. One further point worth mentioning concerns realist thesis (f). If there are no crucial experiments, if no experimental evidence can be produced which will force one to abandon one's theory in favour of the other, what justification is there for the expectation that all competent human beings will assent to the one true theory should such a theory ever come to light?

### *'Truth-Talk' and the Under determination of Theory by Data*

The ultimate aim of science according to the naive scientific realist is to find the one true representation of how things 'really and truly are'. But studies in the logic of verification and falsification suggest that this focus on the truth-value of theories is misguided. To insist that the aim

of science is to find the one true theory makes sense only if it is possible to determine that a theory is true when in fact it is true, and that a theory is false when in fact it is false. But arguably the most important event in the philosophy of science in the twentieth century has been the realisation that it is impossible in principle to conclusively establish the truth-value of any given scientific theory or hypothesis. That no theory can be verified has long been established. For despite the fact that a given theory may succeed in 'saving the phenomena', no amount of experimental confirmation warrants the belief that the theory is true. To believe in the truth of the theory on the basis of past confirmations is to accept the validity of inductive arguments, or to commit the fallacy of affirming the consequent.<sup>15</sup> It has also been made clear that we cannot assign varying degrees of probability to scientific theories because, according to the logic of probability, all theories are equally improbable whatever the experimental evidence might be.<sup>16</sup> Similar difficulties confound our attempts to falsify theories. As Popper points out, scientific theories are not 'falsified' by a single recalcitrant observation report, but by what he has called an observation law, i.e., a law to the effect that a particular observation report is *always* to be expected given certain initial conditions. But as Edwards points out, ". . .our justification in rejecting [a] theory as *false* can be *no stronger than* our justification in accepting the observation law as *true*. But the only justification we could have for accepting the observation law as true would be [an] *inductive* argument."<sup>17</sup> What is more, the Duhemian thesis establishes that we cannot conclusively falsify any given scientific theory, even if the difficulties of inductive arguments could be avoided, since no theory ever confronts experience alone.<sup>18</sup> These results, reinforced by the preceding remarks concerning the theory-ladenness of observation, have led many to reject 'truth-talk', at least with respect to scientific theories, as unwarranted metaphysical speculation. Consequently it makes little sense to insist that acceptance of a scientific theory implies acceptance of that theory as true. But if truth-talk is deemed inadmissible with respect to scientific theories, then the ultimate aim of the scientific realist must be rejected as well.

Our inability to establish the truth value of a given theory by appealing to the available empirical evidence (what I will refer to as the under

determination of theory by data) is illustrated nicely by a rather striking theoretical possibility. It would seem that for any given finite set of observations it is theoretically possible to construct two 'ideal' yet mutually incompatible theories.<sup>19</sup> A theory is said to be 'ideal' if it has the set of attributes one would desire in a theory short of its being established as 'true'. Usually such attributes include the theory's conformity with the experimental evidence, its simplicity and elegance, the ease with which observation sentences are derived from it, etc. But this standard of 'ideal' can be relaxed without depriving our theoretical possibility of its force. For if ever one is presented with two incompatible theories both of which succeed in 'saving the phenomena', i.e., if one is unable to decide between two theories on empirical grounds alone, then one is forced to adopt other criteria to justify a preference for one theory over the other.<sup>20</sup> Yet the other criteria do nothing to establish that one theory is closer to the truth than the other. Simplicity, elegance, the ease with which one derives observation sentences, etc., certainly make a theory 'user-friendly', and this feature is enough to justify *using* one theory rather than another. But it does not justify the claim that the user-friendly theory is closer to the truth than the complicated, clumsy theory.

Nor does this problem disappear if at any given moment only one ideal theory happens to be available.<sup>21</sup> A theory's being alone in the field does not rule out the possibility that another ideal theory can and will be constructed in the future. It is on these grounds that the argument in favour of the adoption of that theory which provides the 'best explanation' cannot be admitted as decisive in the realist dispute in science. That a theory provides the best available explanation certainly justifies its adoption as part of a research programme; but not the inference that the theory is true. What we deem the 'best explanation' tells us more about our state of knowledge than it does about the truth value of the theory.

The under determination of theory by data has other repercussions as well, in particular with respect to our standards of competency. As mentioned above, the competency of a scientist is a function of both intellectual and moral qualities. A scientist's moral qualities in



particular are in part displayed by his willingness to abandon assumptions and pet hypotheses should the experimental evidence demand this. This willingness is taken as a sign of intellectual honesty. However, such standards have had to be progressively relaxed in the face of the difficulty of establishing the truth value of theories.<sup>22</sup> At first it was deemed intellectually honest to "desist from unproved utterances and minimise, even in thought, the gap between speculation and established knowledge." This criterion had to be relaxed in the face of the impossibility of conclusive verification. Intellectual honesty was then construed in terms of confining oneself to the assertion of only those propositions one knew to be probable. This criterion too was eventually rejected. Finally, it was deemed intellectually honest to assert only theories that one knew had yet to be falsified by experience, or to state precisely under what conditions one would be willing to give up a theory. Now it seems there are no experimental results which can force one to give up a position should one be willing to preserve it. It is now unclear just what standard of intellectual honesty scientists ought to hold themselves to.

Two significant points have emerged from this discussion. First, there is the charge that truth-talk with respect to scientific theories is metaphysical speculation at best, a charge that scientists of all stripes have prided themselves on avoiding. Indeed it is in opposition to metaphysical speculation that the natural sciences have understood themselves. Secondly, we have further grounds for doubting that all competent human beings will inevitably recognise the one true theory as true even if such a theory were presented to us. All the evidence suggests that two fully rational, diligent, and sincere human beings can fundamentally disagree with respect to their theoretical interpretation of the world, *without either one being open to the charge of irrationality or incompetence*. On the contrary, it is the continued indulgence in truth-talk that is open to this most unsavoury of charges.<sup>23</sup>

### *The Results of Historical Research*

With the last objection in mind it is perhaps not surprising that

historians of science have found fault with the theory of scientific progress outlined in (g). Kuhn has argued persuasively that scientific development is rarely an uncontroversial process of incorporation and evolution achieved in accordance with methodological rules and assumptions accepted by the scientific community as a whole. Great scientific advancements in particular seem to be marked by factionalism and conflict within the scientific community, and revolution rather than evolution.<sup>24</sup> Feyerabend has supported this thesis both by his studies of Galileo's defence of the Copernican hypothesis against the Aristotelians and Catholic Church and his own form of the incommensurability thesis. This view of scientific development as revolutionary rather than evolutionary now stands virtually unchallenged, and proponents of this view apparently no longer feel the need to argue for it explicitly in the course of their historical works.<sup>25</sup> The implications of this challenge to the traditional view have been twofold. First, there is corroborating evidence of what was hinted at in the last objection, viz., that science and scientific development is not an entirely rational process achieved according to accepted rules, methods and assumptions.<sup>26</sup> Second, the denial of the evolutionary view of scientific change suggests that science is not necessarily an accumulative process either, but one where theoretical entities and entire theoretical systems may be dropped completely by the scientific community.

### *Scientific Realism and the wider Intellectual Community*

There are politically motivated objections brought against naive scientific realism which we ought to note. Although our primary interest is not with the moral and political aspects of science, we cannot fail to notice that science has an impact beyond its borders, and that this impact is not always entirely positive. Indeed, there is a growing segment of society convinced that science generally, and naive scientific realism in particular, can have undesirable social effects. Feyerabend is perhaps the most noted proponent of this view,<sup>27</sup> arguing that the dogmatism which a simplistic scientific realism can promote is as harmful to the interests of a 'multi-cultural' society as that of a

dogmatic theologian or religious leader. Similar complaints brought forward by various political interest groups who have come to see science as less than socially and environmentally benign are increasingly common place.

In a closely related problem, it is often argued that a simplistic scientific realism can lead to serious distortions and errors in debates in other intellectual disciplines. Distortion can be the result of applying the methodology of the natural sciences in inappropriate areas, while errors are unavoidable if parties to disputes in another intellectual disciplines take received scientific doctrine as an unquestioned starting point for their own discussions. An illustration of the problematic use of received scientific doctrine by philosophers will serve to bring this home. The principle of causal closure - the thesis that all physical events have physical causes - has been taken by some to be the rock on which various forms of dualism in the philosophy of mind meet their end.<sup>28</sup> Dualists are meant to be embarrassed on the grounds that they fall afoul of this time honoured principle of the sciences. Now whatever one's views in the philosophy of mind (and I certainly have no desire to defend Cartesian dualism), this argument cannot be taken as conclusive until we can justify a realist interpretation of the principle of causal closure. Is it in fact the case that all physical events have only physical causes? Or it is better to say that the assumption in favour of the principle of causal closure has hitherto led to fruitful research? Until we have a sophisticated hermeneutics of scientific theory (and one that achieves some level of consensus) the immediate application of 'received' scientific doctrine in other areas is problematic.

### *Consideration of the objections to scientific realism*

The above objections are serious indeed. The problem of providing a consistent interpretation of all scientific theory is, if not insurmountable, then sufficiently worrying to dampen any optimism one might have. The two objections based on semantic considerations, the difficulty of defining theoretical terms and the blurring of the theory/observation dichotomy, seem to force the point that we have no

theory-free observation language. Precisely what we ought to make of this will be considered in what follows. The inability to conclusively verify or falsify any given theory is also severely damaging to naive scientific realism since it puts in question the meaningfulness of continuing to indulge in truth-talk. When to the foregoing objections we add the accumulating historical evidence it seems impossible to defend claim (d) - it is unreasonable to maintain that the aim of science is to discover the one true theory of the Real. The same goes for the thesis that once this theory is found it will command the assent of all rational, diligent and sincere human beings. And the rejection of (d) entails the rejection of the first part of (e), viz., the claim that to accept a theory is to accept it as true, or 'approximately' true. The results of historical research also make claim (g) concerning the evolutionary and rule-governed progress of science untenable without important qualifications.

And yet I do not think scientific realism ought to be given up entirely. I have not been persuaded that the realist has any reason to give up the two founding theses of ontological and epistemological realism, or the commitment to empiricism. The latest results from Quantum mechanics cannot yet be considered safe enough to warrant the rejection of ontological realism simply because the proper interpretation of these results has yet to be determined. But given the 'theory-ladenness' of all observation, some have suggested that a weaker form of ontological realism is required. It could be maintained that the world still *exists* independently of our representation of it, but that any *structure* we find in it is of our own making. In this case the nature of the world is in some sense dependent upon our representation of it. This neo-Kantian suggestion ought to be resisted. It carries the unwelcome, and as yet unwarranted implication that somehow we are at least partially responsible for the structure of the Real. Before taking such a step we ought to hold out for very substantial arguments indeed. However, how we perceive reality is undeniably a function of our conceptual scheme. But this is an *epistemological* point rather than an ontological one. The import of theory-ladenness upon epistemological realism will occupy us at some length in what follows. But in anticipation we can say that the proper response to these objections is

not to abandon scientific realism entirely, but to develop a more moderate, less naive form of realism. This moderate realism ought to be construed along the following lines:

- a) *Some* terms in our scientific theories actually refer to extra-linguistic entities, i.e., entities on which our thinking has no effect, and which exist before we come to know them.
- b) The existence of these entities is demonstrable.
- c) Of these entities we can form true statements.

Two problems immediately presents themselves. First, some means of identifying *which* terms refer to such entities is needed; second, it remains to determine what is to be made of the *other* terms in our theories. For an answer to this later question we ought to examine the other interpretative tradition.

### ***Scientific Anti-realism (Instrumentalism)***

There are several forms of scientific anti-realism, including phenomenalism, fictionalism, or simply scepticism concerning scientific hypotheses; but the account of scientific anti-realism which will serve as our model is that provided by van Fraassen in his work *The Scientific Image*. There is a significant over-lap with scientific realism for van Fraassen retains a commitment to ontological and epistemological realism, as well as a fondness for empiricism; but he parts company with the scientific realist on the matter of the aim of science generally, and on the matter of what it means to accept a theory. All the modifications to scientific realism can be traced back to this fundamental change in doctrine. He writes:

Science aims to give us theories which are empirically adequate; and acceptance of a theory involves as belief only that it is empirically adequate.<sup>29</sup>

To accept a theory as 'empirically adequate', he says, is to accept "that what the theory says *about what is observable* (by us) is true."<sup>30</sup> In

older terminology, an 'empirically adequate' theory is one that 'saves the phenomena'. This is a significant modification of the realist project in that it puts a strict limit on truth-talk. The scientific realist understood science to be aiming at the discovery of the one true theory of the 'Real' *in its entirety*. On the other hand, the scientific anti-realist à la van Fraassen confines his truth-talk to those sentences purportedly about the realm of the Real which is observable by us.

At first sight the principle attraction of scientific anti-realism is that it avoids some of the embarrassing objections scientific realism had been open to on account of its predilection for unrestricted truth-talk. Indeed scientific anti-realism could easily be seen as that position which remains once scientific realists have rid themselves of their penchant for unwarranted metaphysical speculations. But it is not really enough to see scientific anti-realism as a mere modification of scientific realism, for the modifications are such as to completely transform the general understanding and tone of the scientific enterprise. In fact it could be said that by setting limits on truth-talk the heart of scientific realism is cut out and summarily abandoned, for it drops the idea that scientific theories tell us how the totality of facts about the world 'really and truly are'. And nowhere is this change of tone more in evidence than when the anti-realist forwards his interpretation of those theories which purport to represent aspects of the Real inaccessible to observation by us. All formulations of scientific anti-realism include the thesis that such theories are merely useful intellectual tools. A good scientific theory on this reckoning, apart from being simple and elegant, is one which allows the scientist to make accurate predictions concerning observable phenomena. Nagel writes:

a theory is held to be a rule or a principle for analysing and symbolically representing certain materials of gross experience, and at the same time as an instrument in a technique for inferring observation statements from other such statements.<sup>31</sup>

Van Fraassen's scientific anti-realism can then be characterised by the following claims:

- a) *The aim of science is the provision of theories which are 'empirically adequate'.*
- b) *To accept a scientific theory is to accept that what that theory says about what is observable by us is true.*
- c) *Theories ostensibly about aspects of the Real which are not accessible to observation are merely more or less adequate instruments for the derivation of observation sentences from other observation sentences.*

Scientific anti-realism construed along these lines is clearly a far more modest proposal than that forwarded by scientific realism. For one, it conspicuously drops any ontological commitment to the theoretical entities ostensibly named in empirically adequate theories. As a consequence, the anti-realist is free to employ any theory which suits him as an instrument of prediction, even if it conflicts with other empirically adequate theories when considered realistically. And while the commitment to epistemological realism remains, it is significantly modified. The scientific anti-realist still maintains that we can know something of the nature of the Real; but our knowledge is limited in principle to that realm of the Real which is observable by us. What is more, the anti-realist is not committed to the traditional views of the development of science outlined above. Given that theories are instruments rather than representations of the Real, the anti-realist does not think that theories are ever closer and closer approximations of the truth. Instead the anti-realist sees the development of increasingly empirically adequate theories, increasingly powerful calculi, accompanied by a more comprehensive knowledge of the world which is observable by us. In this sense theories are not just instruments of prediction but heuristic devices as well. They can serve this end by focusing the scientist's attention on phenomena hitherto unobserved because they had passed unnoticed. To modify Eddington only slightly, the anti-realist wants theories that 'contain nothing that is unobservable, but a great deal that is unobserved'. And by abandoning the fixation on the truth value of theories, the anti-realist also gains a measure of 'psychological' freedom, as it were, to take on board new theories with greater ease. It is much easier psychologically to accept a new tool as part of one's general conceptual equipment than it is to take on board a significantly different world view, simply because so much

less is invested in tools than in beliefs.

In order to further clarify the nature of van Fraassen's scientific anti-realism it is helpful to distinguish it from three other forms of anti-realism. For example, unlike Dummett and other semantic anti-realists, van Fraassen can maintain that representational sentences are true or false in virtue of states of affairs in the world, and that truth is a possibly verification transcendent property of sentences. This view of truth will be examined in detail in the following chapters. Other anti-realists can accept van Fraassen's view of truth, but are anti-realists about certain areas of discourse because they maintain there simply are no facts these discourses can represent. Hartry Field's anti-realism in mathematics is a good example of this form of anti-realism.<sup>32</sup> Van Fraassen is not an anti-realist of this sort; he is not a scientific anti-realist because he thinks there are no unobservable facts to represent. He states explicitly that his anti-realism has no ontological implications because he does not maintain that all that is is observable.<sup>33</sup> The phenomenalism of Mack is decidedly not part of scientific anti-realism as understood by van Fraassen. Indeed Mack's position falls prey to the charge of unwarranted metaphysical speculation as surely as scientific realism. A third type of anti-realist denies that sentences in an area of discourse which are ostensibly representational are in fact representational at all, and as such are neither true nor false. It is argued that some sentences may share grammatical similarities with genuinely representational sentences without their actually being representational. This is not van Fraassen's position either. Van Fraassen can maintain that sentences ostensibly about electrons or force fields are in fact statements about electrons and force fields. Nonetheless, a sentence may be representational without meriting a realist interpretation.

There are a number of objections to scientific anti-realism so described, the most persistent of which are the following:

*Scientific practice does not conform to this picture of science*



Nagel writes that "neither logic nor the facts of scientific practice nor the frequently explicit testimony of practising scientists supports the dictum that there is no valid alternative to construing theories simply as techniques of inference."<sup>34</sup> In the same breath it is often suggested that scientists would not be motivated to carry out their work if they adopted this view.

### *The Existence of Theoretical Entities*

Our scientific anti-realist will not accept any ontological commitment to unobservable entities named in scientific theories. This means the scientific anti-realist is at odds with respectable science, a charge deemed to be inherently embarrassing.

### *The 'Ultimate Argument'*

If our scientific anti-realist does not accept that scientific theories are approximately true, it becomes difficult to explain the obvious success of science. Putnam offers a good account of what van Fraassen calls this 'Ultimate Argument':

The positive argument for realism is that it is the only philosophy that doesn't [sic] make the success of science a miracle. That terms in mature scientific theories typically refer, that the theories accepted in a mature science are typically approximately true, that the same terms can refer to the same thing even when it occurs in different theories - these statements are viewed by the scientific realist not as necessary but as part of the only scientific explanation of the success of science, and hence as part of any adequate description of science and its relations to its objects."<sup>35</sup>

### *The Theory/Observation Dichotomy Revisited*

Our scientific anti-realist still relies on the traditional distinction

between theory and observation. And yet there has been no answer to the objection brought against the scientific realist concerning the impossibility of a theory-free observation language.

*Problems arising from abandoning unrestricted 'Truth-Talk'*

Our scientific anti-realist faces the serious charge of "falling back on irrationalism."<sup>36</sup> If scientists can no longer appeal to the objective truth or falsity of a theory as a reason for accepting or rejecting it, how is science to retain the semblance of objectivity which is at the heart of its appeal? By refusing to speak of the truth or falsity of theories, the scientific anti-realist appears to open the door to a complete relativism, where all manner of wonderful possibilities are considered to be on an equal footing, or to a straightforward scepticism. This objection is expressed rather colourfully by van Fraassen in these terms:

You [the anti-realist] will have to admit that there are possibilities you cannot prove or disprove by experiment, and so you will have to say that we just cannot know what the world is like. Worse; you will have no reason to reject any number of outlandish possibilities; demons, witchcraft, hidden powers collaborating to fantastic ends.<sup>37</sup>

And, as was the case with scientific realism, the impact of scientific anti-realism is not contained within the confines of science alone. 'Irrationalism' in the sciences threatens to break out into the community at large with undesirable politico-moral results. Lakatos presents the political fallout of anti-realist tendencies with all suitable alarm:

The clash between Popper and Kuhn is not about a mere technical point in epistemology. It concerns our central intellectual values, and has implications not only for theoretical physics but also for the under-developed social sciences and even for moral and political philosophy. If even in science there is no other way of judging a theory but by assessing the number, faith and vocal energy of its supporters, then this must be even more so in the social sciences: truth lies in power. Thus Kuhn's position would

vindicate, no doubt unintentionally, the basic political *credo* of contemporary religious maniacs. . . ." 38

These consequences provide reasonable grounds for regarding scientific anti-realism with suspicion. Popper and Lakatos in particular can be seen as responding to precisely this problem thrown up by scientific anti-realism. But once one digs beneath the bluster and protestations it becomes apparent that their concern is not so much to drive off scientific anti-realism per se (indeed both accept that the Duhem-Quine thesis put the final nail in the coffin of objective 'truth-talk' with respect to scientific theories<sup>39</sup>) as it is to preserve for science some semblance of objectivity and rationality despite the fact that no appeal to objective truth can be made. Their particular dispute is between 'methodological falsificationism' and 'irrationalism', rather than between naive scientific realism and a scientific anti-realism as described above. Indeed Popper's 'methodological falsificationism' and Lakatos' refinements thereof provide no support for scientific realism. Popper's methodological falsificationism employs 'observation' sentences, and succeeds in 'falsifying' theories only in a technical sense. For what counts as an 'observation' sentence, and what hypotheses are deemed 'falsified', is decided *by fiat, by convention*, rather than by agreement or disagreement with the 'objective facts', whatever they might be. This methodological procedure comes at the cost of abandoning any pretence of scientific realism, unless we are prepared to accept the possibility that the world is ontologically dependent upon our conventions. No realist will be satisfied with a theory deemed to be 'true' in only this conventional sense. But Popper and Lakatos do hope to preserve a degree of objectivity and rationality for science by providing agreed upon rules for the 'falsification' of theories. If successful this would make the passage from one paradigm to the next more than an 'irrational', subjective procedure.

### *Consideration of the objections to scientific anti-realism*

The first two objections brought against scientific anti-realism make appeals to respectable scientific practice and theories, as well as to the

testimony of scientists themselves. But both objections are in danger of begging the question. One cannot reasonably decide this issue by appealing to the authority of scientist's beliefs and practices when it is precisely this authority which is in question. The philosopher cannot enter this dispute in good faith if he or she has already decided which scientific theories are to be safeguarded a realist interpretation. We must insist that while the actual practices of scientists are no doubt of interest, as are their views of their work *qua* scientists, these cannot be taken as decisive in the realm of philosophical argument, and consequently cannot be decisive arguments for or against scientific realism or anti-realism. In the same way that a sociologist or anthropologist may come to a different understanding of their subject's behaviour than that held by their subjects themselves, so too philosophers cannot be constrained by the views of the scientists *qua* scientist. On the other hand, the views scientists hold of their work *qua* philosophers ought to be listened to with interest; but as such they enter the philosophical debate on the same level as any other philosopher who applies himself to these matters.

Nor can it be the primary concern of the philosopher interested in the realist dispute in science to bolster the morale of the scientist in the trenches. The philosopher engaged in this dispute is not first and foremost a cheerleader or a detractor of scientists and their practices. This is not to say that philosophers ought not to have any leanings either way (an impossible and unreasonable demand); but a particular leaning cannot be made a precondition for admittance to the philosophical debate without seriously affecting the objectivity of that debate as a whole.

But this is not to suggest that there are no serious concerns the scientific anti-realist is bound to address. It is not unreasonable to insist that an explanation of the success of scientific theories to function as instruments of prediction is required. The motivation to discover objectively true beliefs about the world is largely explained by our assumption that true beliefs about the nature and structure of our environment help us to survive and achieve our practical ends within that environment. And the instrumentality of an idea is usually

explained by the fact that the idea is taken to be an accurate, or 'adequate', depiction of some aspect of the external permanency. Given this natural interpretation of the close link between instrumentality and truth, the anti-realist must explain how success is possible *without* positing some relationship of adequacy between the theory and the world in which it is successfully employed. It is not enough for the anti-realist to say, as does van Fraassen, that scientific theories 'work' because they would not be used if they did not. Van Fraassen's interpretation of the success of certain theories relies heavily on the analogy he draws between biologically successful organisms and successful scientific theories. The success in both cases, he claims, is explained in terms of the principle of natural selection. He illustrates his view by considering the case of the mouse who runs from its natural enemy, the cat. He writes:

St Augustine already remarked on this phenomenon, and provided an intentional explanation: the mouse *perceives that* the cat is its enemy, hence the mouse runs. What is postulated here is the 'adequacy' of the mouse's thought to the order of nature: the relation of enmity is correctly reflected in his mind. But the Darwinist says: Do not ask why the mouse runs from its enemy. Species which did not cope with their natural enemies no longer exist. That is why there are only ones who do.<sup>40</sup>

The point of this example is that "only the successful theories survive", and for precisely the same reasons that one finds only mice which run from cats, viz., if they were not successful they would not be used by scientists.<sup>41</sup> But this analogy misses the point behind the Ultimate Argument. To continue with van Fraassen's analogy, the question was not: Why do some members of a species survive while other die off?, but rather: How can any species or individual survive at all? Similarly, the question was not: Why do scientists use only successful theories?, but rather: How is it that any scientific theory can work as an instrument of prediction and control in the first place? And van Fraassen seems to acknowledge this point. He says, "Only the successful theories survive - *the ones which in fact latched on to actual regularities in nature.*"<sup>42</sup> This is a significant concession to the Ultimate Argument, since it acknowledges that successful theories get something right.

Similarly, the related objections concerning the anti-realist's relapse into irrationality, and the damage this does to science's role as a liberating force for good in the political arena are also worth serious consideration. If a rigid dogmatism of any form is undesirable, so too is an unrestrained relativism.<sup>43</sup> And this applies even if one accepts that Feyerabend is right to insist that a plurality of views is necessary for the successful continuation of science itself. Part of the challenge of a responsible scientific anti-realist position will be to set a non-arbitrary limit on the bounds of relativism while avoiding any unwarranted dogmatism. But if the scientific anti-realist must accept this challenge (which I think he does) it is not because he ought to be working to bring about some desired political effects, but because the dichotomies 'rational'/'irrational', and 'objective'/'subjective' involve philosophical terms that ought to be clarified by philosophers.

But this talk of dichotomies brings us to the most pressing concern facing the anti-realist. Our anti-realist is still relying on the problematic theory/observation dichotomy. But this is a problem shared with the moderate realist. Both the moderate realist and the anti-realist need some way to distinguish between qualitatively distinct terms: the realist is looking to isolate those terms in our scientific theories which refer to entities whose existence is demonstrable, and whose nature can be known; while the anti-realist needs to distinguish between observable and unobservable realms of the Real. But arguably both distinctions are making the same cut. Both mean to distinguish between knowable and unknowable domains of the Real. If there is any doubt on this point we need only remember that our anti-realist maintains that to accept a theory is to accept that what the theory says about what is observable by us *is true*. So both the moderate realist and anti-realist accept that we can make true statements about some section of the Real (and not just empirically adequate statements) but that not *all* scientific statements can be taken as true. So if we can draw this fundamental distinction to the satisfaction of realists and anti-realists, could we not expect that scientific realism and anti-realism could ultimately be united into one coherent position? And if so united, could we not expect that the excesses of each position, which have exposed

them to the objections discussed above, would be mitigated when each is balanced and completed by its opposite number? Indeed, one begins to wonder if the opposition between moderate realism and anti-realism has not been born of the fact that the anti-realist tends to focus on those terms in our scientific theories which refer to entities whose existence and nature are not demonstrable, while the moderate realist focuses on those entities we can know. But these need not be incompatible attitudes; indeed what follows is an attempt to combine these two attitudes into one coherent position in the realist dispute in science. What remains to be seen is *how* this distinction might be drawn to the satisfaction of both, and *where* the demarcation will lie once the distinction is drawn.

### ***An Important Final Word***

But there is a serious objection to *both* scientific realism and scientific anti-realism which must be considered before there can be any point at all in trying to forge a synthesis between these two interpretative traditions. Both scientific realism and scientific anti-realism are forms of *metaphysical realism*. Objections to this common ground of scientific realism and anti-realism must be dealt with before there can be any point in attempting to synthesise these two interpretative traditions. For the purposes of this study metaphysical realism includes a commitment to strong ontological realism, and to the thesis that truth is to be understood as a possibly verification transcendent property of sentences.<sup>44</sup> The metaphysical realist is committed to the claim that we can utter a sentence which is true or false without our being able to determine its actual truth value. Another way to express this is to say that the metaphysical realist is committed to the Principle of Bivalence, i.e., that all representational sentences are either true or false regardless of our ability to determine which truth value any given sentence happens to have.<sup>45</sup> These claims have recently come under attack from semantic anti-realists. Consequently our first studies must deal with this particular charge.

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<sup>1</sup> See Nagel's *The Structure of Science: Problems in the Logic of Scientific Explanation*. Indianapolis: Hackett Publishing Company, 1979, Ch. 6.

<sup>2</sup> This paragraph is little more than a paraphrase of van Fraassen's leading question in *The Scientific Image*. What is the aim of scientific activity in general, and what does one believe upon acceptance of a theory? *The Scientific Image*. Oxford: Clarendon Press, 1980, p.18.

<sup>3</sup> Charles Peirce. "The Fixation of Belief" in *Philosophical Writings of Peirce*, edited by Justus Buchler. New York: Dover Publications, 1955, p. 18.

<sup>4</sup> Cambridge: Cambridge University Press, 1983, p.26.

<sup>5</sup> Peirce describes convergence in these terms: "One man may investigate the velocity of light by studying the transits of Venus and the aberration of the stars; another by the oppositions of Mars and the eclipses of Jupiter's satellites; a third by the method of Flizeau; a fourth by that of Foucault; a fifth by the motions of the curves of Lissajoux; a sixth, a seventh, an eighth, and a ninth, may follow different methods of comparing the measures statistical and dynamic electricity. They may at first obtain different results, but, as each perfects his method and his processes, the results are found to move steadily together towards a destined centre. So with all scientific research. Different minds may set out with the most antagonistic views, but the progress of investigation carries them by a force outside themselves to one and the same conclusion." "How to make our ideas clear", in *The Philosophical Writings of Peirce*, p.38.

<sup>6</sup> One could in fact insist that only a metaphorical interpretation is acceptable, and point out that scientists themselves use phrases to suggest such an interpretation. For example a scientific textbook printed in 1985 instructs the reader to 'think of light as waves of radiation.' [my emphasis] J. M. Pasachoff. *Contemporary Astronomy*, third ed. Philadelphia: Suanders College Publishing, p.14. The heuristic value of this metaphor is not in question. At issue is whether light is a wave of radiation, and in what sense it is a 'wave'. Interestingly the author goes on to attribute properties to light waves that could in no sense be attributed to ordinary waves from which the focal sense of the term 'wave' is derived, and upon which the metaphor is based. We read: "In fact, light, x-rays, and radio waves are all examples of rapidly varying electric fields and magnetic fields that have become detached from their sources and move rapidly through space."(p. 14) It is clear that such a wave is very unlike waves of water or other liquids which cannot be detached from their medium.

<sup>7</sup> Lee Smolin, "What is Time?" in *How Things Are*. Edited by Brockman and Matson. Great Britain: Weidenfeld and Nicolson, 1995.

<sup>8</sup> See Mermin's, "Quantum Mysteries for Anyone", in the *Journal of Philosophy*, vol. 78, 1981.

<sup>9</sup> Ibid.

<sup>10</sup> For an account of the effects of theory on observation see Hanson's "Observation" and Feyerabend's "On the Interpretation of Scientific Theories", both in *Theories and Observation in Science*, R. Grandy ed., Prentice Hall, 1973.

<sup>11</sup> See Quine's "Posits and Reality", in *Theories and Observation in Science*, and chapter 15 of Feyerabend's *Against Method*. London: Verso, 1991, p. 155. The latter writes, "A distinction which once may have had a point but which has now definitely lost it is the distinction between *observational* terms and *theoretical* terms. It is now generally admitted that the distinction is not as sharp as it was thought to be only a few decades ago."

<sup>12</sup> See van Fraassen, p.15.

<sup>13</sup> Quine in particular seems to suggest something like this in "Posits and Reality". Since the term 'desk' is as theoretical as the term 'electron'; and since we are not inclined to give up our belief in the reality of desks, we ought to be willing to accept the reality of electrons.

<sup>14</sup> Feyerabend examines this situation nicely in his *Against Method*.

<sup>15</sup> Let 'T' refer to a theory to be tested, 'AH' to auxiliary hypotheses, and 'O' to



observation sentences or set of observation sentences derivable from T, AH, and the set of initial conditions 'IC'. We can then present the logic of verification as follows:

- 1)  $T + AH + IC \rightarrow O(1 \dots n)$
- 2)  $O(1 \dots n)$
- 3)  $T + AH + IC$

But this is the fallacy of affirming the consequent. Despite the favourable experimental outcome, nothing has been established regarding the truth of T (except, some might say, it has not been falsified). Although a theory may successfully save the phenomena, so might many others. The only way anything could be established concerning the truth value of T would be to demonstrate that no other set of hypotheses capable of generating O is possible. How one could establish this is unclear.

<sup>16</sup> See Popper's extensive studies in the logic of probability in *The Logic of Scientific Discovery*, London: Unwin Hyman, 1980, and Lakatos' "Changes in the Problem of Inductive Logic", in *The Problem of Inductive Logic*, Lakatos ed., 1968, p. 315-417.

<sup>17</sup> Jim Edwards, *Philosophy of Science*. Course text book, p. 85.

<sup>18</sup> Consider the case presented in note no.10 with the single alteration that O has not obtained as expected. We then get:

- 1)  $T + AH + IC \rightarrow O(1 \dots n)$
- 2)  $\neg O(1 \dots n)$
- 3)  $\neg (T + AH + IC)$

This is formally valid. But all that has been 'falsified' is the *conjunction* of T, AH, and the initial conditions. T has not been singled out for special attention by the falsifying report, and cannot be except by the scientist's choosing to allow it to be viewed as the culprit rather than AH or IC. Any defender of T can legitimately attempt to find some other combination of auxiliary hypotheses and T from which  $\neg O$  is derivable and thereby 'save' T. Only if it were established that it is impossible to save T in this manner could T be falsified. How this could be done is not clear. See Duhem's, *The Aim and Structure of Physical Theory*, Princeton, New Jersey: Princeton University Press, 1954 (Chapter VI, Part II), and Quine's "Two Dogma's of Empiricism" in his *From a Logical Point of View*, Second Ed. London: Harvard University Press, 1980. The Duhem-Quine thesis was challenged by Adolf Grunbaum in his article 'The Duhemian Argument'. But Laudan pointed out that Grunbaum 'misconstrued' the thesis by interpreting Duhem to have said that any T can be saved come what may. Laudan writes, "Duhem is not asserting that every hypothesis can be saved, but only that unless one had proved that it cannot be saved, then it is not falsified." Both articles can be found in *Can Theories Be Refuted?*, an excellent collection of papers on the Duhem-Quine thesis, and its consequences for the philosophy of science. Edited by Sandra Harding, Boston: D.Reidel Publishing Co., 1976.

<sup>19</sup> Kuhn remarks that, "Philosophers of science have repeatedly demonstrated that more than one theoretical construction can always be placed upon a given collection of data." *The Structure of Scientific Revolutions*, 2nd edition. Chicago: University of Chicago Press, 1970, p. 76.

<sup>20</sup> Kuhn writes: "Observation and experience can and must drastically restrict the range of admissible scientific belief, else there would be no science. But they cannot alone determine a particular body of such belief. An apparently arbitrary element, compounded of personal and historical accident, is always a formative ingredient of the beliefs espoused by a given scientific community at a given time." *Ibid.*, p.4.

<sup>21</sup> It should be made clear that at no time has such a theory been available.

<sup>22</sup> This paragraph relies heavily on Lakatos' "Falsification and the Methodology of Scientific Research Programmes" in *Can Theories Be Refuted?*, p. 203.

23 It was with some bemusement that I found such sentiments expressed by St. Augustine in his *Confessions*. Although he is dealing with problems in the interpretation of scripture rather than physical theory, the point remains the same. After discussing the difficulty of reaching any firm conclusions concerning the correct interpretation of the creation story in *Genesis*, and putting his own theory forward with notable hesitancy, he writes: ' . . .when a man says 'Moses did not mean what you say, but what I say', and yet does not deny that both his interpretation and mine are consistent with the truth, then, O Life of the poor, O my God, in whose bosom there is no contradiction, I beg you to water my heart with the rain of forbearance, so that I may bear such people in patience. They speak as they do, not because they are men of God or because they have seen in the heart of Moses . . .that their explanation is the right one, but simply because they are proud. *Confessions*, Book XII, Ch. 25. Translation by Pine-Coffin. Great Britain: Penguin Classics, 1988.

24 What makes Kuhn's work so interesting is that in addition to showing that scientific development is revolutionary, he also explains *why* it must be so.

25 I refer the reader to A. Bowdoin Van Riper's recent study, *Men Among the Mammoths: Victorian Science and the Discovery of Human Prehistory*. Chicago: University of Chicago Press, 1993, as a case in point. The author has fully incorporated the Kuhnian picture of scientific development (in fact he follows the Kuhnian paradigm to the letter). But there is no mention of Kuhn anywhere in the text itself, let alone a defence of the paradigm.

26 I could be criticised by some for not making this point more firmly. For according to a respectable source modern science had its origins in irrationality and has remained 'anti-rational' to this day. Whitehead writes in his *Science and the Modern World* that, "It is a great mistake to conceive this historical revolt (the scientific revolution) as an appeal to reason. On the contrary, it was through and through an anti-intellectualist movement . . . based on a recoil from the inflexible rationality of medieval thought." (p. 10-12) He goes on to say: "[Modern Science] has remained predominantly an anti-rationalist movement, based upon a naive faith. . . . In other words, it has never cared to justify its faith or to explain its meanings; and has remained blandly indifferent to its refutation by Hume." (p. 20) Cambridge: University Press, 1932.

27 See Feyerabend's *Science in a Free Society*. London: Verso, 1982.

28 See Smith and Jones, *The Philosophy of Mind*. Cambridge: Cambridge University Press, 1986. We are told that Cartesian dualism must be wrong because it "goes clean against a fundamental principle of science, namely that the cause of physical changes are other entirely physical events." (p.58).

29 *The Scientific Image*, p.12.

30 *Ibid.*, p. 18.

31 *The Structure of Science: Problems in the Logic of Explanation*. Indianapolis: Hackett Publishing Co., 1979, p. 129.

32 Hartry Field's *Science Without Numbers* is a good example of this form of anti-realism. Oxford: Basil Blackwell, 1989.

33 *The Scientific Image*, p. 18.

34 *The Structure of Science: Problems in the Logic of Explanation*, p. 139.

35 *The Scientific Image*, p. 39.

36 *Can Theories Be Refuted?*, p. 206.

37 *The Scientific Image*, p. 35.

38 *Can Theories Be Refuted?*, p. 206.

39 See Lakatos' discussion of Popper's methodological falsification in "Falsification and the Methodology of Research Programmes" in *Can Theories Be Refuted?*

40 *The Scientific Image*, p. 39.

41 *Ibid.*, p. 40.

42 *Ibid.*, p. 40.

<sup>43</sup> Bloom's discussion of the impact of relativism on the intellectual climate at universities in the US should give us all pause. Anyone working in the UK or Canada will recognise the symptoms described in his controversial *The Closing of the American Mind*. New York: Simon and Schuster, 1987.

<sup>44</sup> There is some debate as to whether metaphysical realism is also committed to epistemological realism. Some contend that it makes little sense to accept ontological realism if one then goes on to deny epistemological realism (see John Haldane's "Ontological and Epistemological Realism in Aquinas", (p. 2) to appear in *Realism and Reason*). I tend to agree with Haldane on this point, but I do not intend to discuss it in any detail. Suffice it to say that if one accepts ontological realism it seems to imply that *some form* of epistemological realism will also be maintained.

<sup>45</sup> Future contingents excepted.

## Chapter 2

### *Putnam and the nature of reference*

In the *Introduction* a survey was made of the traditional arguments used in the on-going debate between scientific realists and scientific anti-realists. We now need to examine a challenge to both positions in the realist dispute in science stemming from those who insist that the anti-realists *have not gone far enough* in their repudiation of the guiding assumptions of scientific realism. It is in the work of Hilary Putnam and that of semantic anti-realists like Michael Dummett and Neil Tennant that this historically recent challenge to instrumentalism is to be found. It is to the examination of their views and the problems they raise that we now turn.

#### *The Semantic Anti-Realist Challenge*

Implicit in scientific realism and scientific anti-realism is the assumption that theories are 'measured' by the world. Theories are true or false in virtue of their success or failure to adequately represent the Real. It is the gap existing between our theories and the world which creates the condition for our theories being classically true when an adequate representation is achieved, and classically false when this adequacy relation fails to obtain. But as we saw in the last chapter, it is now widely recognised that truth-talk with respect to scientific theories is misguided since we are never in a position to claim that we have actually verified or falsified any given theory or hypothesis. The Duhemian thesis in particular demonstrates that it is possible in principle to construct empirically adequate yet mutually inconsistent theories for the same set of observations. Much has been made of this thesis, and it is the cornerstone of Quine's philosophy of language and science as presented in *Two Dogmas of Empiricism*. But there is an immediate corollary to this thesis which demands attention: If it is possible to construct two empirically adequate yet mutually inconsistent theories for the same set of data, then we can conclude that *an empirically adequate theory may be 'classically' false*, given that only one but not both empirically adequate theories could be true at the same time. This corollary is consistent with two fundamental theses of metaphysical realism. First, truth is thought to be a possibly verification transcendent property of sentences, i.e., a theory is said to

be true or false in virtue of states of affairs in the world which might happen to be beyond our ken; second, the world is thought to be ontologically independent of our representation of it.

However, this corollary, that an empirically adequate theory may yet be false, is considered by semantic anti-realists to be incoherent and untenable. In fact the corollary can be taken as a *reductio ad absurdum* of the metaphysical assumptions and the accompanying notion of truth from which it is derived. Studies in the philosophy of language, and semantics in particular, have led some to the view that sentences are true or false not in virtue of states of affairs in the world, *but in virtue of our having evidence to warrant its assertion or its denial*. According to semantic anti-realists the truth value of a sentence is not possibly verification transcendent; on the contrary, truth is taken to be epistemically constrained by our ability to warrant its assertion or its denial. Now on this view of truth it makes no sense to say that an empirically adequate theory might be false: If a theory is empirically adequate it is warranted by the available evidence; consequently it is *ipso facto* true by definition. And presumably if the theory is 'true', it warrants a realist interpretation. Indeed, the scientific anti-realist's refusal to commit himself to the existence of those entities named in empirically adequate theories is considered as at best an empty agnosticism, or, as we will see, a misguided scepticism stemming from an incoherent theory of reference.

If the metaphysical realist view of truth proves to be incoherent there will be immediate consequences for those concerned with the realist dispute in science. If we are forced to adopt a view of truth as warranted assertability, there will be little reason to maintain an anti-realist position in science. Indeed, many theories appear to be warranted by the available evidence, and consequently many theories will be 'true'. But this is hardly likely to please the scientific realist. The scientific realist wants theories that are 'true' in the traditional sense of the term, not just well supported theories; indeed, the number of well-founded but eventually rejected theories is legion. And there are other unpalatable consequences. If the nature of Reality itself is determined by the evidence we happen to have at any given moment (a view semantic anti-realists have difficulty avoiding), it would appear that the commitment to ontological realism must be abandoned in

favour of a form of metaphysical idealism. Consequently, in order to preserve a firm scientific realism as well as a form of scientific anti-realism, our first order of business must be to defend the coherence of the view of truth shared by metaphysical realists.

### *Putnam's Alleged Refutation of Radical Scepticism*

A defence of the coherence of metaphysical realism would do well to consider the particular problems raised by Putnam concerning the nature of reference before attempting to deal with the semantic anti-realist challenge more closely associated with Dummett. A study of Putnam will also bring into focus the nature of the conflict between metaphysical realists and semantic anti-realists. At the root of the conflict is the dispute about the connection between one's ontological and epistemological commitments. The metaphysical realist feels that, while remaining a metaphysical realist, he could consistently maintain a commitment to ontological realism without committing himself to any form of epistemological realism. That most metaphysical realists (including both scientific realists and anti-realists) do in fact hold some form of epistemological realism is not to the point. At issue is the fact that the theoretical possibility of radical scepticism is not ruled out by metaphysical realist commitments. It is precisely this theoretical possibility which is attacked by Putnam in the first chapter of *Reason, Truth and History*. At the heart of his attack is the claim that the metaphysical realist is working with an unacceptable theory of reference. Consequently we need to consider his argument against radical scepticism.

The following is the relevant portion of Putnam's characterisation of metaphysical realism as presented in *Meaning and the Moral Sciences*:

THE WORLD is supposed to be independent of any particular representation of it - indeed, it is held that we might be unable to represent the world correctly at all (e.g. we might all be "brains in a vat", the metaphysical realist tells us).<sup>1</sup>

There is nothing here that contradicts metaphysical realism as defined in the *Introduction*. Consequently, we are obliged to defend the coherence of this admittedly farfetched theoretical possibility. For if

truth is not epistemically constrained, then it is at least possible in theory that the world bears no resemblance to our representations of it. Putnam maintains, however, that he can show that this possibility is incoherent, and that radical scepticism is not tenable. His argument, stemming from a particular theory of reference, invites the conclusion that the statement, 'I am a brain in a vat', is *necessarily false*. The specific question that will occupy us is whether Putnam has laid radical scepticism to rest by demonstrating that it is self-refuting. I will be at pains to show that this argument as it is presented in *Brains in a Vat* is compelling only if certain prior assumptions have been made. In particular, I will show that he *assumes* from the outset that truth is epistemically constrained and not possibly verification-transcendent. Indeed Putnam's argument from the nature of reference can be seen as a variation on a Dummettian theme. An examination of his argument will then lead us quite naturally into Dummett's work where the more fundamental problem of the nature of truth is examined in greater detail.

The main point on which Putnam builds in *Brains in a Vat* is the thesis that thoughts, words, pictures, or mental images do not intrinsically represent or refer to anything. Putnam considers the imaginary case of an ant tracing a picture of Winston Churchill in the sand, and a person uttering words in a language he/she does not understand. Neither the ant nor the speaker has successfully referred to anything, Putnam maintains, although a picture and words have been present. Putnam also uses the distinction between 'seeing' and 'seeing that' to bring out the idea that we can have images, words or thoughts in the head and not be aware that they might be used to refer to anything. One can have an image of a tree before the mind's eye, says Putnam, and yet not refer to a tree. If one does not know what trees are, never having seen or heard of trees and thus having no concept of them, then one cannot refer to trees even if the appropriate image is present. In this case the image is just an image and not an image of a tree. This is the main point he wants to assert against what he calls the 'magical' theory of reference employed, or tacitly assumed, by metaphysical realists who suppose there is this 'magical' or 'necessary' connection between a sign and its referent.

After these preliminary remarks on the nature of reference Putnam develops his well known brains-in-a-vat scenario and his argument that purports to show that we can know that we are not brains in a vat. Putnam's strategy is to show that the statement, "I am a brain in a vat" is necessarily false because it is self-refuting. It is important that it be clear why Putnam thinks this is the case.

The argument turns on his theory of reference. Putnam maintains that successful reference depends on some sort of causal interaction obtaining between, say, a real tree and the speaker who employs an image or thought of a tree, or utters the word "tree" in a sentence. Now 'vat-people', says Putnam, may *believe* they are able to refer to trees; but since, *ex hypothesi*, they have no causal interaction with real trees, they cannot, to Putnam's way of thinking, really refer to trees, even though the mental content of a vat-person may be identical to the mental content of a person actually standing in front of a real tree. Now if a representational sentence cannot be true without successfully referring to something, then the statement 'I am standing in front of a tree', for example, can never be true if uttered by a vat-person. It is not true on a metaphysical realist account of truth because, *ex hypothesi*, the vat-person is in a vat and not in front of a tree. Putnam also maintains that this sentence is false, but for a different reason. It is false on Putnam's account because the conditions of successful reference on which the truth of this sentence depends do not obtain. The difference between these two analyses comes out most clearly when we are faced with the statement, 'I am a brain in a vat'. If a person is not a vat-person then the statement is obviously false regardless of one's views of the nature of reference. But if the person is a vat-person then on the metaphysical realist account the statement is true; yet on Putnam's account the statement is still false because it "does not have the reference conditions that would make it true."<sup>2</sup> Consequently, as far as Putnam is concerned, 'I am a brain in a vat' is false when uttered by a person under normal conditions, and false when uttered by a vat-person; and since these are the only options available, 'I am a brain in a vat' is deemed necessarily false, and radical scepticism defeated.

It is vital that this last move be understood clearly because it is the lynch pin of the whole argument. It is important to recognise that Putnam is not saying that we cannot determine the truth-value of



sentences when the required reference conditions for the truth of a given statement fail to obtain. The lack of the 'appropriate' reference conditions actually entails the falsity of the statement in question. If this were not the case there would be room for the possibility that we are actually brains in a vat but, given our lamentable epistemological condition, we simply cannot warrant an assertion to this effect. But this is a restatement of radical scepticism, not a refutation of it. Only by insisting on the falsity of , 'I am a brain in a vat', can Putnam's argument be seen as a argument against scepticism. To achieve this Putnam must claim that the truth of a statement is dependent upon correct modes of reference obtaining between the user or utterer of a statement and the referents of the terms in that statement, and not upon the statement's correct representation of the facts. This is stated explicitly in *Meaning and the Moral Sciences*: "...the relation of reference totally determines the extension of 'true', as applied to that language."<sup>3</sup>

For those who maintain an epistemically unconstrained view of truth and a non-causal theory of reference this argument will appear a nonsense. In the traditional conceptual scheme truth and being are convertible, i.e. to say something true is to say what is, and conversely, what is, is what is true. The metaphysical realist will insist that the truth of a sentence depends on states of affairs, and not on our being in any particular causal relationship with them. Surely, the metaphysical realist will say, if one is a brain in a vat and one says as much, a true statement has been uttered, regardless of whether or not a particular reference condition has been satisfied. Furthermore, the metaphysical realist will want to know how one and the same statement can be false when uttered by one person and true when uttered by another. If external viewers say of some unfortunate vat-people, "They are brains in vat", they are said to have uttered a true statement. Why should the same proposition suddenly become false when uttered by a vat-person? At issue for the metaphysical realist is the distinction between a true statement and a justified, or warranted statement. Metaphysical realists will argue that the vat-people are correct in their assertion that they are brains in a vat; but, given the peculiarity of their situation, their assertion to this effect is not warranted. And their failure to refer on Putnam's criterion merely underlines the fact that we can have mental images, thoughts, or sense impressions, and not be aware of the 'real' nature of the cause of those images, which is, after all, the

sceptic's position. Putnam's aim, however, is to deny that there is distinction between a true statement and a justified, or warranted statement. It would appear, on Putnam's account of the brains argument, that a sentence cannot be true if it is not warranted. Indeed, there is no distinction between one's ontology and one's epistemology; what is the case depends on what we know is the case.

Let us look at Putnam's argument against scepticism more closely. There are two features to Putnam's theory of reference that require attention. The first is the insistence on a causal theory of reference; the second is the alleged dependence of the truth predicate upon the conditions of this particular notion of reference obtaining. If reference does require a direct causal link, *and* the truth of a statement is dependent upon this type of reference relation obtaining between the speaker and referent, then metaphysical realists will be forced to give up the idea that truth is verification transcendent and the coherence of radical scepticism will be shattered. But before accepting such a conclusion the metaphysical realist requires an answer to two questions. Why tie truth to a causal theory of reference? And what reasons can be given for accepting a causal theory of reference in the first place? Let us consider the causal-connection element of this theory of reference first.

### *Reference and Causal Connections*

Does successful reference really require a direct causal connection between speaker and referent? It seems plain enough that some sort of link is needed, but the nature of this link is unclear. It is interesting to note that in *Brains* Putnam simply asserts that in the case of the ant and the non-Japanese speaker reference has failed to occur without saying exactly why they failed. Most would agree that they did fail to refer; but various reasons for the failure could be entertained, some of which could be accepted by metaphysical realist. One need not deny that signs do not inherently refer to anything to agree that the ant failed to refer to Churchill. It could be argued that the ant fails to refer because, presumably, it had no intention to use the drawing in the sand to refer to Churchill. One need not insist that the failure is due to the fact that the ant has no causal connection to Churchill. And the non-

Japanese speaker uttering a sentence in Japanese fails to refer because s/he does not know what s/he is saying, not because the correct causal relation between speaker and referent does not obtain. But things are less clear in the case of the vat-people. The metaphysical realist is quite willing to accept that the vat-person does refer when s/he utters the statement 'I am a brain in a vat'. What argument does Putnam offer against the metaphysical realist on this point?

There are four arguments to consider altogether, three of which can be treated in this chapter. First, there is the suggestion that metaphysical realists have difficulty explaining how one manages to refer to entities and situations to which one has not been causally related. In effect, reference is a bit of a mystery which the metaphysical realist cannot solve. More of this anon.

Second, Putnam might appeal to the principle of charity adopted from Quine and Davidson in order to justify his particular reading of 'vat-discourse'. One reason for rejecting the more natural metaphysical realist interpretation of vat-discourse is that on this reading almost all vat-sentences must be deemed false. (In fact on this reading one of the very few statements to come out true is precisely that they are brains in a vat.) This is in direct violation of the principle of charity championed by Quine and Davidson which states that the best translation or interpretation of another's discourse is the one that makes the largest percentage of the target statements true. The translator's guiding principle is to choose that reading which puts the target statements in the best possible light, the operating assumption being that the foreign-language-speaker would not assent to or use sentences that are manifestly false. Now it is true that the metaphysical realist reading runs afoul of the letter of the principle of charity; but Putnam must accept that his version of the vat-discourse (which can make their statements come out as true) is highly revisionary, if not excessively so. Indeed it completely ignores the intentions of the vat-people, and produces sentences the vat-people would not recognise as their own. But rather than reject the principle of charity, (a hasty and unwise move given its obvious merits in other more traditional situations where interpretation is being attempted), it would make far more sense to see vat-discourse as a limiting case of the principle of charity. This principle ought to be applied in those circumstances where translator

and foreign-language speaker are in roughly equivalent epistemological conditions. Quine and Davidson did not envisage this principle of translation being applied to the discourse of such a clearly disadvantaged people. It is only misguided loyalty to a principle that would lead one to apply it to such an atypical case as that of the vat-people.

Third, Putnam could be following the likes of Quine and Wittgenstein in insisting that meanings, (and hence reference, as a component of meaning) must be manifestible and accessible to public scrutiny and not hidden away in the head. (The speaker's intentions, for example, cannot be appealed to to explain reference because intentionality is not amenable to public scrutiny.) But it is worth noting that Putnam himself is not quite sure how to characterise this reference relation in terms that would suit Quine or Wittgenstein. In fact his lack of confidence in this area is so deep that he even admits that a non-causal theory of reference might be correct after all. Consider these lines from *Meaning and the Moral Sciences*:

What a speaker means when he utters U could/can be determined by seeing what *belief* standardly accompanies U (or, perhaps, what *belief* one *intends* to convey in uttering U, à la Grice and Shiffer). This looks like what Quine calls the "museum myth" of meaning in psychological fancy-dress. (The "museum myth" is the unhelpful theory that there are objects called meanings and what a sentence means is determined by which of these objects it is "attached" to.) But perhaps the "museum myth" is *true*. Perhaps Quine just is easy to answer. (This is what Noam Chomsky seems to think.)<sup>4</sup>

It is important to bear in mind while reading this quote Putnam's declared views on the nature of meaning. In particular one must remember that meaning, for Putnam, *includes* reference as a integral component, and that it is precisely this "museum myth" view of meaning that is maintained by metaphysical realists. But there is no mention here of the speaker being causally related to the objects referred to in U. Just how the speaker is related to these objects is left unspecified. In fact it would appear that the speaker's *intention* may be sufficient for successful reference.

But let us assume that Putnam in his stronger moments would not

consent to such a complete capitulation to the metaphysical realist cause. What, then, is Putnam's real view of this reference relation? Again we run into difficulties because Putnam is not entirely clear on this matter. At times it appears that Putnam's argument demands that this relation be one of direct causal interaction between the speaker and the referent. This is the picture one naturally assumes while reading *Brains in a vat*. Indeed the argument against scepticism relies on the fact that the brains in a vat do not have any direct connection to the objects their discourse is ostensibly about. It is precisely this lack of direct connection that is responsible for their statements not having the reference conditions to make them true. This reading is encouraged by lines like the following:

The... premise is that one cannot refer to certain kinds of things, e.g. *trees*, if one has no *causal interaction* with them, or with things in terms of which they can be described.<sup>5</sup> (My emphasis)

But we (unlike the brains) are able to perceive, handle, deal with apples and fields. Our talk of apples and fields is intimately connected with our *non-verbal* transactions with apples and fields.<sup>6</sup>

. . . 'vat' refers to vats in the image in vat-English, or something related (electronic impulses or program features), but certainly not to real vats, since the use of 'vat' in vat-English has no *causal connection* to real vats.<sup>7</sup> (My emphasis)

Similar lines can be found throughout this particular essay, and they all suggest that a direct, physical connection must obtain between speaker and referent.

However, Putnam is not entirely happy with this picture of the nature of reference. In fact he appears to imply that it is only acceptable if certain qualifications concerning the nature of the causal relation are made. In *Meaning and the Moral Sciences*, we read:

(b) indicates that reference cannot, for example, be defined by 'X refers to Y if and only if X (a particular utterance of X) is connected to Y by a causal chain of the appropriate type'. (Of course, phrases like 'causal chain of the appropriate type' are extremely vague, so maybe the causal theories can evade this

by allowing global constraints to enter in determining what the 'appropriate type' of causal chain is.)<sup>8</sup>

This remark seems at odds with those found in *Brains*, where it was implied that reference is dependent upon such physical actions like 'handling' and other 'non-verbal transactions'. Reference is, of course, not a physical activity itself (what it is remains to be seen) but it seems to be dependent upon certain physical events having occurred.<sup>9</sup>

So what is required for successful reference according to Putnam? In particular, is a direct causal link necessary or not? Putnam is not entirely clear on this matter. But what is clear is that the argument in *Brains* goes through only if reference is dependent upon a direct causal connection between speaker and referent. Putnam makes this clear by listing those translations of vat-discourse he finds acceptable. He writes:

On some theories that we shall discuss it [the vat discourse] might refer to trees in the image, or to electronic impulses that cause tree experiences, or the features of the program that are responsible for those electronic impulses. These theories are not ruled out...for there is a close causal connection between the use of the word 'tree' in vat-English and the presence of trees in the image, the presence of electronic impulses of a certain kind, and the presence of certain features in the machine's program.<sup>10</sup>

It would appear from these lines that, in *Brains* at least, Putnam is holding a very strong version of the causal connection theory of reference. Let us take Putnam at face value and agree that this is a view that he at least seriously entertains. We can now ask whether this theory of reference is supported by the case of the vat-people, or whether he simply manages to use this scenario to illustrate in a graphic manner the nature and consequences of this particular theory. Because Putnam has given up the museum myth of meanings inside the head, he is forced to conclude that reference is not simply a matter of the speaker's intention. Consequently he must find some observable process upon which to hang the occurrence of reference. This leads directly to the counter-intuitive suggestion that the vat-people could be taken to be referring to states of machines (although they are unaware of this). But again we are left wondering why this suggestion is to be

taken seriously, let alone adopted. It is true that according to the principle of charity the vat-sentences might now be construed as true. But this is achieved only by doing violence to the speaker's own view of their sentences. As mentioned above, vat-discourse ought to be taken as a limiting case of the principle of charity.

If one's enthusiasm for such a crude causal theory of reference is therefore difficult to maintain, as indeed it was for Putnam himself, two points immediately present themselves for consideration. Firstly, what becomes of the argument against scepticism which relies on this theory of reference? If this direct causal connection is not required what prevents us from attributing successful reference to the vat-people? Second, if the link between referrer and referent is not a crudely causal one, as some of Putnam's own work suggests, then what is the nature of the reference relation? Putnam's answer to this question leads us directly into the fourth objection against the metaphysical realist.

Putnam's suggestion in *Reason, Truth and History* quickly takes us to the heart of his internal realism. It is in fact while discussing a key problem for the causal theory of reference, namely how one manages to refer to the unobservable entities postulated by modern science, that Putnam writes the following lines:

In an internalist view. . . signs do not intrinsically correspond to objects, independently of how those signs are employed and by whom. But a sign that is actually employed in a particular way by a particular community of users can correspond to particular objects *within the conceptual scheme of those users*. 'Objects' do not exist independently of conceptual schemes. We cut up the world into objects when we introduce one or another scheme of description. Since the objects *and* the signs are alike *internal* to the scheme of description, it is possible to say what matches what.<sup>11</sup>

It now becomes only too clear just what price is being paid for giving up the magical theories of reference. Putnam is able to avoid the particular difficulty concerning the 'magical' nature of reference that besets us if we are wedded to a world view in which it is maintained that the world exists independently of our theoretical representations of it. In particular the metaphysical realists leave it unexplained as to how we can refer to entities that we have never encountered. This problem is removed with one stroke once we give up our initial metaphysical

assumption and accept that the world *does not* exist independently of our representation of it. The 'magical' nature of reference is eliminated because a causal connection between speakers and their referents is guaranteed. We create the very objects we are referring to in the first place. What better causal link could one ask for? Putnam also eliminates the seemingly insoluble problem of radical scepticism. Since we create our world ourselves, we are in a very good position to claim that we can have real knowledge of it. Our theories are no longer 'measured' by a world we seek to know; we know our world because we have made it what it is.

But is this theory of reference, which seems to entail the rejection of the ontological independence of the world, an acceptable alternative to the magical theory of metaphysical realism? More importantly, has any argument been presented that forces one to adopt such a view? or is it merely the case that an alternative approach has been developed and presented for our consideration? The latter appears to be the case, for significant problems arise for Putnam's view of reference. For one, are language users like ourselves objects we have created? And if we have not brought ourselves into being through language (which seems self-evident) how do we know that we are the only theory independent entities? Is one forced to recognise two forms of reference, one, a direct causal relationship between speaker and referent with the direction of causation flowing from objects to person, and a second causal relationship of creation/reference with an inverted causal flow, from person to object? How would we establish which mode of reference holds in each particular case, or would it matter? That reference in some cases is indeed a 'mystery' for the metaphysical realist is one reason why one is quite naturally inclined to at least consider Putnam's internal realism. But is the magical theory of reference any more mysterious or magical than the relation Putnam suggests exists between ourselves and the world? The cost of adopting an internal realist perspective is high indeed. It is in fact so high that more than a puzzle about reference is needed before any metaphysical realist is going to embrace it.



### *Truth as Epistemically Constrained*

But there is an argument for Putnam's position which never appears in *Brains*. Some while back it was said that there are two aspects to Putnam's argument, one, the causal nature of reference, the other, the connection between reference and truth. The point I want to make about this second aspect of Putnam's argument is the following. Putnam's views on reference are consistent with a commitment to a notion of truth as epistemically constrained. Indeed, as intimated earlier, Putnam's views on the nature of reference make sense and are compelling once we have abandoned the metaphysical realist understanding of truth. The truth of a statement does depend on successful reference having been achieved, even within the traditional conceptual scheme where truth is held to be verification transcendent. But in the traditional scheme reference does not require either a direct causal link between speaker and referent, let alone the creation of the referent by the introduction of a conceptual scheme by the speaker. But once one has adopted a conception of truth as epistemically constrained one's views on the nature of reference must be adapted to suit this conceptual framework. Once this is understood it becomes clear that the commitment to the view that the truth of a sentence depends on a reference relation along Putnam's lines is in fact simply another expression of that line of thought which insists on denying that truth is a verification transcendent property of statements. With the semantic anti-realists, as we will see shortly, no statement can be deemed true if it is not warranted by some evidence that is at least in principle available for inspection. I would argue that by making the truth of a statement dependent upon his particular notion of reference Putnam is simply restating this demand. For both Dummett and Putnam a statement's truth value is not determined by its correspondence to the facts or its failure to so correspond *because we may never be in a position to decide effectively which of these alternatives in fact obtains*. Instead a statement's truth value is determined by some other factor whose obtaining is always within our abilities, at least in principle, to establish. Putnam's views on reference are an expression of precisely this demand for accessibility. The true referent of a given term must be something that is accessible to an outside observer of the language user, not something hidden away in the language user's head. By making reference depend on a causal

connection between speaker and referent Putnam ensures that the referent at least at some point was accessible to public scrutiny.

Where does this leave us? It seems that in order for Putnam's argument against scepticism to go through his views on reference must be accepted. We have seen that there is reason to be hesitant on this score. More to the point, we have seen that these views are compelling only within a conceptual framework operating with an epistemically constrained notion of truth. But Putnam has not given any particularly forceful argument for the adoption of this initial point of departure, although the argument against the coherence of metaphysical realism clearly relies on it. Such an argument, however, can be found in Dummett. It is to this argument that we must now turn.

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<sup>1</sup> Hilary Putnam, *Meaning and the Moral Sciences*. London: Routledge and Kegan Paul, 1978, p.125.

<sup>2</sup> Putnam. *Reason, Truth and History*. Cambridge: Cambridge University Press, 1981, p.51.

<sup>3</sup> *Meaning and the Moral Sciences*, p. 39.

<sup>4</sup> *Ibid.*, p.49-50.

<sup>5</sup> *Reason, Truth and History*, p. 16.

<sup>6</sup> *Ibid.*, p. 11.

<sup>7</sup> *Ibid.*, p.14.

<sup>8</sup> *Meaning and the Moral Sciences*, p.40.

<sup>9</sup> This is the view Neil Tennant ascribes to Putnam: "Reference is not a physical relation . . . . Neither reference or cause is physically definable, but both cause and reference supervene on the physical." *Anti-realism and Logic*. Oxford: Clarendon Press, 1981, p. 240.

<sup>10</sup> *Reason, Truth and History*, p. 14.

<sup>11</sup> *Ibid.*, p. 52.

## **Chapter 3**

### ***The Dummettian Reductio***

I concluded the last chapter by saying that Putnam's argument against radical scepticism as found in the opening pages of *Reason, Truth and History* (which I have taken as containing an implicit attack on the coherence of both scientific realism and anti-realism) depends on a particular understanding of the nature of reference. I also argued that this understanding is itself compelling only within a conceptual framework the key element of which is an epistemically constrained notion of truth. However, while it is true that Putnam has developed an interesting and, to some, attractive, philosophical position largely predicated upon the commitment to such a notion of truth, I did not find in his work any particularly forceful argument that might persuade one to abandon the metaphysical realist notion of truth as a possibly verification transcendent property of sentences. The object of this chapter is the examination of just such an argument. As intimated at the close of the preceding chapter, it is in the work of Dummett and the *semantic* anti-realists that this argument is to be found. Our attention, therefore, will be focused on what has been called the 'Dummettian Reductio', or what I will refer to as the 'manifestation argument'. Once the nature of this argument is clear I will move on to consider a possible *semantic* realist response.

The examination of the manifestation argument will take us ever deeper into problems in the philosophy of language. This may strike some as leading us ever further astray from the realist dispute in the philosophy of science. However, those who champion this branch of philosophy, and this argument in particular, claim that its import extends far beyond the boundaries of the philosophy of language. What is more, it should be clear already that if it can be used to support a position like Putnam's, its import for the realist dispute in science is only too real. It is, then, quite proper to continue our excursion into the philosophy of language and to give this argument attention commensurate with the importance of its alleged consequences.

#### *Naturalism vs. Mentalism in Semantics*

A brief digression into related matters in the philosophy of language is

necessary before the manifestation argument can be intelligibly discussed. In particular a few words concerning the debate between what might be called 'naturalists' and 'mentalists' in semantics will allow us to place the argument in its proper context. This discussion will also allow us to establish that the manifestation argument *is not* based on assumptions that are questionable from the point of view of semantic realists. This is, after all, the principle attraction of the manifestation argument: the semantic principles on which it is based are broadly acceptable to both semantic realists and anti-realists alike.

In twentieth century philosophy of language there seems to be general cross party agreement on certain fundamental points about language, the process of language acquisition, and the nature of meaning. Following the lead of thinkers as diverse in character as Wittgenstein and Dewey, many philosophers of language have been attracted to what Quine refers to in 'Ontological Relativity' as 'naturalism' about language.<sup>1</sup> This naturalism is favoured over past theories of meaning that are decidedly 'mentalistic'. The point at issue in this debate between naturalism and mentalism with respect to the nature of meaning turns on the question of whether an essentially private language is possible. The details of this debate need not concern us here as the parties to our particular dispute are all in agreement concerning the impossibility of such a language. However, it is important to recognise why semantic realists and anti-realists are in concert on this question because it is this agreement which provides the common conceptual framework in which the manifestation argument arises.

The principle that both the semantic realist and anti-realist can accept, which is also the motivation behind the rejection of the possibility of an essentially private language, is clearly expressed in the opening paragraphs of Quine's essay 'Ontological Relativity'. There he quotes the words of Dewey: "Meaning . . . is not a psychic existence; it is primarily a property of behaviour."<sup>2</sup> Quine accepts this thesis as following from seemingly undeniable observations concerning the conditions governing the possible communication of meanings from one language user to another. These observations and reflections lead him to assert that:

Language is a social art which we all acquire on the evidence

solely of other people's overt behaviour under publicly recognisable circumstances.<sup>3</sup>

and,

What the naturalist insists on is that, even in the complex and obscure parts of language learning, the learner has no data to work with but the overt behaviour of other speakers.<sup>4</sup>

The principal conclusion drawn from the recognition of the importance of overt behaviour to communication is that meanings must be *manifestible* in the overt linguistic and behavioural practices of language users. All meanings are gleaned from overt, public behaviour, and there is nothing more to meanings than the behaviour that embodies those meanings.<sup>5</sup> Hence the dictum: meaning is exhaustively determined by use. This is the thinking behind the attack on the 'pernicious' mentalistic schools of thought which situated meanings in the hidden recesses of each individual mind, or identified them with unobservable states of the soul. This mentalistic school allowed for the possibility that some aspect of meaning might not be amenable to manifestation in public behaviour and yet retain its status as a meaning. Such thinking opens the door to the theoretical possibility of an essentially private language, i.e., a language that is not communicable to other members of one's community. This possibility is unequivocally rejected by modern semantic theorists who have unreservedly accepted the naturalist approach to semantics. This common attitude displayed by both semantic realists and anti-realists has been dubbed 'semantic externalism':

Semantic Externalism: 'no item which is epistemically private to the speaker - which no one other than he can know the nature of - can be essential to the meaning of any symbol, word or phrase he uses. . .' <sup>6</sup>

Now the importance of semantic externalism, for the purposes of our debate, is that it affects one's theory of what it is to understand a sentence, and additionally, what counts as *manifestation* of a speaker's grasp of a given sentence. It is here that the debate between the semantic realist and anti-realist begins.

### *The Manifestation Argument*

According to traditional realist semantics, to understand a sentence is to understand its truth conditions, i.e. to understand what must be the case in order for that sentence to be true. The semantic anti-realist also thinks that knowledge of truth conditions is central to one's understanding of a sentence, but with an important difference. The truth conditions that one knows when one understands a sentence must be ones whose obtaining one is capable of recognising, and whose obtaining justifies the assertion of the sentence in question. In other words, for the semantic anti-realist, not just any truth conditions are acceptable; in particular, no truth conditions of a given sentence that are verification transcendent will be accepted in the account of the meaning of the sentence in question. The truth conditions of a given sentence that are acceptable by anti-realist standards are those that are epistemically constrained, ones that speakers are able to recognise as obtaining when they do obtain.

This difference in policy with respect to truth conditions has radical implications. By accepting possibly verification transcendent truth conditions in his semantics, the realist remains at home with the intuitions of the metaphysical realist. Like the metaphysical realist, the semantic realist thinks the world is that in virtue of which a sentence has truth conditions, is that in virtue of which a sentence is true or false. Hence it is a possible and indeed frequent occurrence that a sentence is true (or false) without our ever being able to know it to be true (or false). A sentence's truth conditions on this line of thinking are independent of the possibility of our knowing whether those conditions actually obtain. The semantic anti-realist by contrast, says that that in virtue of which a sentence is true (or false) is a truth condition that we can recognise as obtaining. In other words, a sentence gets truth conditions when it is possible (at least in principle) to obtain a warrant to assert (or deny) it. A consequence of this position is that no sentence can be true or false if we do not have some sort of evidence available to hand (or reasonably available) that justifies the assertion (or negation) of the sentence. This is the thinking behind the rejection of the principle of bivalence and the law of excluded middle which characterises the Intuitionist logic associated with semantic anti-realist like Dummett.

The important matter at hand, however, is to understand the connection between this rejection of bivalence, the rejection of verification transcendent truth conditions in semantics, and semantic externalism, for it is here that we find the heart of the manifestation argument. Why do semantic anti-realists reject verification transcendent truth conditions? The thinking stems from reflections on the nature of language acquisition, and the communication of meanings from one speaker to another. What the semantic anti-realist is contending is that when we learn a sentence and come to understand what it means, we do not learn just any truth conditions; what we learn is when it is appropriate to assert or dissent from a given sentence. For example, when we come to understand the sentence "Some apples are red", we do not learn what must be the case in order for this sentence to be true. What we learn is to recognise under what conditions one could assert the sentence in question, say, for example, some experience of red apples. An experience of red apples (or perhaps the testimony of a reliable witness) is the requisite condition for the assertion of the sentence "Some apples are red". What is more, one *manifests* one's grasp of this sentence by asserting or denying it as the circumstances dictate.

This is all very well, one might say, but it is unclear how this will justify the rejection of verification transcendent truth conditions in semantic theory. The crux of the matter is that the semantic anti-realist claims that the semantic realist cannot *manifest* his particular grasp of sentences for which there is no warrant in some overt behaviour. The semantic realist claims he understands sentences not currently known to be decidable by grasping their verification transcendent truth conditions. But, says the anti-realist, he has no way of conveying this grasp in overt behaviour, which, as a naturalist, the realist must admit is necessary if the sentence is to have any meaning. Hence, it is not just that learning the meaning of a sentence means learning its *epistemically constrained* truth conditions *and not* its verification transcendent ones, (the former being manifestible in observable behaviour when one asserts or denies a sentence), but that verification transcendent truth conditions *could never be learned at all* because the grasp of such truth conditions is not manifestible in any overt behaviour of those from whom we learn our language. Consequently, if we agree that sentences not currently known to be decidable are

understood by speakers of the language, the semantic realist seems forced to admit that verification transcendent truth conditions are not that in virtue of which one understands a sentence. If the realist is forced to make this admission, he has for all intents and purposes abandoned semantic realism. Dummett expresses these key points as follows:

Whenever the condition for the truth of a sentence is one that we have no way of bringing ourselves to recognise as obtaining whenever it obtains, it seems plain that there is no content to an ascription of an *implicit* knowledge of what that condition is, since there is no practical ability by means of which such knowledge may be manifested.<sup>7</sup>

The denial of any 'implicit' knowledge on the grounds that it is not manifestible is an application of semantic externalism, which denies that meanings can exist that defy manifestation in some overt behaviour. Hence the semantic anti-realist accuses the semantic realist of being mistaken if the latter continues to think that he understands sentences not currently known to be decidable by virtue of grasping their verification transcendent truth conditions. The whole notion of truth as a possibly verification transcendent property of sentences, that has been assumed by realists of all stripes, is therefore suspect and must be rejected.

Tennant has presented this argument very clearly in his book *Anti-Realism and Logic*.<sup>8</sup> There he shows that three separate commitments semantic realists are bound to accept are inconsistent. These commitments are referred to as 'Manifestation', the claim that the meaning of a sentence "should be fully manifestible in observable exercises of recognitional capacities concerning it"; 'Realism', the adherence to the principle of bivalence; and 'Fact', the claim that currently undecidable sentences are nevertheless understood by competent speakers of the language. It is worth quoting an extended passage of Tennant:

To Dummett belongs the credit for showing that Manifestation plus Realism plus Fact is inconsistent. In briefest outline, his argument is as follows: Accept Fact: so take any sentence S that is undecidable but understood by a speaker X. That is, suppose that X grasps the meaning of S, but possesses no means by which he can recognise either that S is true or that



S is false. By Realism, either the condition for the truth of S obtains, or the condition for its falsity obtains. If the former, X nevertheless, *ex hypothesi*, cannot show that he recognises the fact; if the latter, likewise. But now this contradicts Manifestation, which requires that X should be able to display his grasp of the meaning of the sentence X [sic] by the exercise of such a recognitional capacity concerning it.<sup>9</sup>

Such then is the argument from manifestation which semantic anti-realists forward against semantic realists. Such is the challenge to the coherence of all forms of realism, metaphysical, scientific, and semantic, which rely on a verification transcendent notion of truth. It should be noted that the force of the argument as presented by Tennant, if indeed it is found to be sound, would necessitate the dropping of one of the three commitments. There is no particular reason why the commitment to the principle of bivalence in particular need be dropped. But given the realist's acceptance of the naturalistic tendencies that underlie 'Manifestation', and the acceptance of 'Fact', the pressure of the *Reductio* is at least initially on the principle of bivalence. Let us now turn our attention to how the semantic realist might respond to this argument while remaining true to the naturalist tendencies which dominate modern semantic theory.

### *The Outline of a Possible Semantic Realist Response*

The problem semantic realists face is that of demonstrating how speakers of a language are able to manifest their grasp of sentences not currently known to be decidable (hereafter referred to as 'disputed sentences') in overt and public behaviour. The problem is further exacerbated by the fact that semantic anti-realists insist that this behaviour must consist in 'the exercise of a recognitional capacity' with respect to the sentence in question. However, if the recognitional capacity that is exercised in the case of a given sentence must be such as to effectively decide the truth value of the sentence, then there is no way, *ex hypothesi*, that this will be achieved for the class of disputed sentences. However, the semantic realist ought not to accept that the only manner in which one can manifest one's grasp of the meaning of a sentence is by means of some type of effective decision procedure. Semantic realists are not committed to the claim that all sentences are presently decidable, or even decidable in principle. What they must

defend is that one's understanding of a currently undecidable sentence is achieved by grasping its verification transcendent truth conditions, and that those conditions can be specified, or identified, by *some* overt, manifestible behaviour, and not necessarily a form of behaviour that effectively decides the truth value of the sentence. If this can be achieved the realist will have a good case for claiming he has remained true to his naturalist principles while retaining the principle of bivalence.

There are a number of defensive strategies a semantic realist might employ against the manifestation argument. The most satisfying responses to my mind do not rely solely on the recitation of the absurdities to which the rejection of bivalence leads, although these absurdities are decisive if the realist position can be shown to be internally coherent. One such defence can be found in Anthony Appiah's *For Truth in Semantics*. In this work Appiah shows that the manifestation argument relies on a problematic version of verificationism or on scepticism about induction concerning semantic properties (see Part Two in particular). His method of attacking the manifestation argument is to cut semantic anti-realism off at the legs, as it were. I should note my general agreement with Appiah's critique, although I do not intend to comment on it or to rely on it in what follows. I propose, rather, to supplement Appiah's negative critique of semantic anti-realism by denying that semantic realism falls afoul of the naturalist tendencies that inspire modern semantics. I will also argue that, ultimately, the semantic anti-realist is in no better position than the semantic realist to give the semantics of the disputed sentences. Thus, rather than preventing the manifestation argument from getting off the ground at all, which is Appiah's strategy, I am content to let it be forwarded and simply deny the consequences claimed for it by semantic anti-realists.

It will perhaps be useful at the outset to outline the shape my argument is to take. Key to my defence of semantic realism will be a picture of language based on the work of Quine. The essential works of Quine on the philosophy of language are, of course, 'Two Dogmas of Empiricism', *Word and Object*, and, to a lesser extent, *Ontological Relativity and Other Essays*. From these writings emerges what I will argue is a balanced

and defensible view of how sentences get their meaning, and how these meanings are manifested. What we find in these works is a warrant to assert that the meaning of *certain* sentences is determined by the relations that hold between those sentences and other sentences in the language; and that manifestation of one's grasp of the meaning of those sentences is achieved by indicating what those relations are, and *not* by the exercise of a recognitional capacity concerning them. This reliance on a holistic view of language will allow semantic realists to assert that truth remains a possibly verification transcendent property of sentences *and* that meaning is nevertheless exhaustively determined by use, as is required by semantic externalism.

The semantic anti-realist can respond to this use of holism in three ways. First, and most obvious, he can attempt to discredit the realist's use of holism on the grounds that it is not a workable theory of language. This is a matter on which Dummett in particular has had much to say. The second alternative open to the anti-realist is to accept the use of holism in principle but claim that it cannot help the realist achieve his particular objective. We will consider two arguments in this vein. Finally, the anti-realist can attempt to give the semantics of the disputed sentences without resorting to any form of holism and claim that this gives them a tidier, more manageable theory of language. My strategy is to show that the semantic anti-realist fails to make good these three lines of attack. If it can be shown that semantic anti-realists are unable either to block the realist reliance on a holistic view of language, or to give an alternative semantics of currently undecidable sentences, then, given the well documented counter-intuitive consequences of the rejection of bivalence, there will be no reason to accept the semantic anti-realist programme.

### *Quine's Linguistic Holism*

A review of Quine's entire philosophy of language will not be necessary for our present purposes. All we need focus on at the moment is the extent to which Quine's philosophy of language is holistic. A brief account of his views on language as found in 'Two Dogmas' and in *Word and Object* will suffice to give the needed appreciation of a significant shift in his views with respect to holism. The key ideas to focus on are

what has been called the 'inextricability thesis', and Quine's views on the question of the primary unit or bearer of meaning in a language.

In 'Two Dogmas' Quine introduced the now familiar picture of how language works, namely, the view that language is an articulated structure made up of a network of sentences that are interrelated to one another and to sensory experiences. Now, a particularly relevant aspect of Quine's views in 'Two Dogmas' is what Dummett has called the 'inextricability thesis', i.e. the view that ultimately there is no hard and fast distinction between analytic and synthetic sentences in the language. This inextricability thesis is really the combination of two other striking theses Quine proposed alongside his network theory of language. Quine presents them as follows:

...it becomes folly to seek a boundary between synthetic statements, which hold contingently on experience, and analytic statements which hold come what may. *Any statement can be held true come what may*, if we make drastic enough adjustments elsewhere in the system. Even a statement very close to the periphery can be held true in the face of recalcitrant experience by pleading hallucination or by amending certain statements of the kind called logical laws. *Conversely, by the same token, no statement is immune to revision.* Revision even of the logical law of excluded middle has been proposed as a means of simplifying quantum mechanics<sup>10</sup> (My emphasis).

The important feature of Quine's view of language, for our present purposes, is implicit in the inextricability theses, namely, a claim about the primary unit or bearer of linguistic meanings. Frege had made an advance upon older semantic theories when he substituted the sentence for the word as the primary bearer of linguistic meaning. But in 'Two Dogmas' Quine suggests that the primary unit of meaning in the language cannot be the individual sentence on its own because the meaning of an individual sentence is determined by its connections with other sentences in the language taken as a whole. Indeed, a single sentence extricated from the language has no determinate meaning until it is located within a language. This has led some to the conclusion that it is impossible to understand an individual sentence until one understands the entire language in which it is found. The implication of this view is that the meaning of each individual sentence in the language is not determined solely or primarily by the meanings of

its constituent parts, but by its logical relations to the rest of the sentences in the language. It is these two features of Quine's early philosophy of language, the inextricability thesis and a commitment to a thoroughgoing holism, that are central to our discussion of the manifestation argument and Dummett's attack on holism.

This picture of language, however, is significantly altered in Quine's later work, *Word and Object*. As Dummett points out, although the network theory of language is still in evidence, the two controversial theses that accompanied it in 'Two Dogmas' have been 'quietly dropped'.<sup>11</sup> In 'Two Dogmas' Quine was at pains to insist that there is no qualitative difference in the nature of sentences in the language, in particular that there is no analytic-synthetic distinction. Sentences are simply more or less near the 'periphery' of the network, and hence more or less likely to be dropped in the face of recalcitrant experience. However, in *Word and Object*, Quine introduces the distinction between 'observation sentences' and 'stimulus-analytic' sentences. The former are said to have a determinate stimulus meaning, while the latter are said to be such that 'no stimulus will prompt dissent from them.'<sup>12</sup> Dummett has argued quite convincingly that by drawing this distinction Quine has effectively withdrawn his assent to the two controversial theses of 'Two Dogmas'. It seems quite clear that observation sentences, at least, will not be saveable in the face of recalcitrant experience; and it is also clear that revisions in the language which were before limited only by the desire of the speaker, are now limited to revisions that leave stimulus-analytic sentences untouched.

This is enough by way of recapping the well known history of Quine's developments in the philosophy of language to allow us to make the needed observations about the nature of language. Quine introduced a radically holistic view of language in 'Two Dogmas', a view that was significantly moderated in subsequent work. In *Word and Object* there is special emphasis on the distinction between observation sentences, which have a determinate stimulus meaning, and stimulus analytic sentences which have no direct stimulus meaning but whose meaning is determined by the relations that obtain between them and other stimulus-analytic sentences and other observation sentences. The point to take away from this is that, in Quine, we find two types of declarative sentence: observation sentences with stimulus meanings,

and non-observation sentences whose meaning are determined in another fashion. What this distinction suggests is that there is going to be a difference in the manner in which one's grasp of sentences is to be achieved, and in the manner in which that grasp will be manifested. If the sentence in question is an observation sentence then it seems appropriate to expect that a speaker will manifest his understanding of the sentence by assenting to it (or dissenting from it) under the appropriate stimulus conditions. This use of assent and dissent to indicate one's understanding of a sentence will also be appropriate in the case of arithmetical sentences (the speaker manifests his understanding by checking the calculation procedure for the sentence in question) or in theoretical sentences of mathematics (the speaker can check the proof offered in support of the given statement). However, if the sentence is a theoretical sentence in the sciences or metaphysics (i.e., one for which there is no deductive proof), or an observation sentence about a particular region of space-time that is beyond the limits of present possible experience, then there can be no deciding stimulus condition that would lead one to assent or deny it. In such cases we must expect that one's grasp of these sentences will be manifested otherwise than by assenting to it or dissenting from it. In fact, a speaker's refusal to assert or deny such sentences is itself an indication that they have grasped the meaning of the sentence. Now if we accept a holistic view of language, the manner in which we would expect a speaker to manifest his grasp of these sentences is obvious: the meaning of this particular type of sentence is determined by its relations to other sentences in the language, and grasp of such sentences will be manifested by the speaker's manifesting his appreciation of what those relations are.

What is worth noticing is that Quine's view of language in *Word and Object* avoids the mistake of the positivists who held that the meaning of theoretical sentences is obtained by reducing them to observation sentences. And, at the opposite extreme, he avoids the problems one encounters in radical holism which suggests that all sentences get their meaning from their location in the network of the language system. The chief point to be made, however, is that in such a picture of how language works the semantic realist can offer an explanation of how one's grasp of the meanings of currently disputed sentences in terms of verification transcendent truth conditions can be manifested in some

overt, public behaviour. The realist who accepts this moderate holism will claim that he manifests his grasp of the truth conditions of the disputed sentences by his adherence to the rules of classical logic - in particular to the introduction and elimination rules of the negation sign and the principle of bivalence. If we can accept that one's grasp of some sentences can be manifested without resorting to a decision procedure leading to assent or dissent, then the problem of the manifestation argument as presented by Dummett and Tennant dissolves. This being the general strategy, we can now move on to consider the semantic anti-realist responses to this use of a moderately holistic view of language.

### *Semantic Anti-Realist Responses*

Our attention now shifts to the question whether the semantic anti-realists have produced an argument which prohibits the realist reliance on a moderate holism. The work of Tennant is particularly useful in this regard as he has conducted a survey of Dummett's writings to find all the arguments the later has seen fit to throw at the holders of a holistic view of language. There is, however, something particularly striking about these arguments, many of which, if they applied, would be a serious blow to holistic hopes. When one reads these arguments as they are presented in Dummett's various works one finds that what Dummett is arguing against is a thorough going holism, the radical holism of 'Two Dogmas'. Tennant implicitly agrees that this is the case, as is shown by his characterisation of Dummett's understanding of holism. In particular Tennant quotes a long passage from 'The Philosophical Basis of Intuitionistic Logic' which captures what Dummett considers to be the essence of holism. The holist maintains that:

it is illegitimate to ask after the content of any single statement or even after that of any one theory, say of a mathematical or physical theory; the significance of each statement or of each deductively systematised body of statements is modified by the multiple connections which it has, direct or remote, with other statements in other areas of our language taken as a whole, and so there is no adequate way of understanding the statement short of knowing the entire language. Or, rather, even this image is false to the facts: it is not that a statement or even a theory has, as it were, a primal meaning which then gets modified by the

interconnections that are established with other statements and other theories; rather, the meaning simply consists in the place which it occupies in the complicated network which constitutes the totality of our linguistic practices.<sup>13</sup>

There is much in this passage which is repeated at the end of the essay 'Original Sinn'<sup>14</sup>, and in 'The Justification of Deduction'<sup>15</sup>, where one of the primary complaints against holism is that one never understands any sentence of a language until one knows the entire language, which would make one's learning of a language seemingly impossible. Even more revealing, however, is that we find in Tennant that Dummett's attack on holism is an attack on a theory that still embraces the two controversial theses that Quine included in 'Two Dogmas', in fact they are given pride of place in the set of axioms meant to represent holism.<sup>16</sup> What emerges from this understanding of what Dummett is attacking is that the particular problems Dummett has with holism are those which are consequences of the acceptance of the two controversial theses. But it is clear that the use of a moderate holism does not depend on one's continued acceptance of the two controversial theses *for all sentences of the language*. One might very well defend these theses *for that section of the language made up of strictly theoretical sentences*. In fact this would result in a position much like that described by Duhem in *The Aim and Structure of Physical Theory*. There is, however, no reason to assume that they are applicable to any sentence whatsoever. Indeed, this was the significance of the new distinction that Quine brought into play in *Word and Object* between observation sentences and stimulus analytic sentences. Now if one rejects the universal application of these two theses it seems that the complaints Dummett brings against holism no longer find the mark. In other words, Dummett provides an attack on *radical* holism (the merits of which do not concern us directly), but no corresponding attack on the moderate holism Quine and others might seek to employ. Consequently the first line of attack is ineffective.

That Dummett's attacks are directed towards a radical holism and not a moderate holism is not particularly surprising, given that semantic anti-realists themselves employ holist principles in one way or another. In a separate chapter of *Anti-Realism and Logic*, Tennant openly declares his intention to seek a compromise position between a strict molecularism and radical holism. This desire leads Tennant to a semantic theory that



sounds remarkably consistent with that I have suggested is to be found in *Word and Object*. Tennant rejects the strict adherence to an exclusively molecular theory and admits that *extra-logical terms are understood in a holistic way*:

. . . it is quite plausible that non-logical concepts or expressions may be non-separable: and our theory of meaning for such expressions would accordingly be a holistic one. The existence of 'semantic fields', only within the whole of which can member-concepts properly be located, could turn a significant field of semantics into a preserve of the holist.<sup>17</sup>

He is also sure that Dummett would have to allow for this limited use of holism, as these lines from 'The Justification of Deduction' suggest he would:

Of course, even on a molecular view of this kind, no sentence can have a meaning which is independent of *all* the rest of the language. Its meaning depends on the meaning of the constituents words, and these in turn depend upon the use of other sentences in which they may occur, and also of expressions of a lower level to which they are logically related: a grasp of the meaning of any sentence must, even on a molecular view of language, depend upon a mastery of some fragment of the language, a fragment which may, in some cases, be quite extensive. Nevertheless, it is essential to such a molecular view that there must be, for each sentence, a representation of its individual content which is independent of a description of the entire language to which the sentence belongs. . . .<sup>18</sup>

Tellingly enough, Tennant sees in this quotation the 'Achilles' heel in Dummett's characterisation of molecularism. For as soon as one admits that the meaning of a sentence depends on the relations that obtain between it and other sentences, one has accepted the essential point of at least the moderately holistic view of language. Tennant has this to say about the consequences of this acceptance:

. . . we then see Dummett's molecularism diluted to a possible blend of globally separable local holisms.<sup>19</sup>

And, as if to make the case for us, Tennant adds:

Nor is this position, combining logical molecularity with possible holism on extra-logical primitives, vulnerable to the

criticisms (given above) that Dummett levelled against the more thoroughgoing brand of holism, from which it significantly differs.<sup>20</sup>

This is the position Tennant offers as an acceptable compromise position between strict molecularism and radical holism. It seems clear from this brief description that the moderate holist of Quine's *Word and Object* would have little difficulty in accepting such a view at least in principle. But has this concession to holism not given the semantic realist what he needs to make good his claim that the grasp of currently disputed sentences may be manifested in other than assent and dissent and other recognitional capacities? It is here that we encounter two new arguments that form the second type of response to the semantic realist's use of holism. Both suggest that while a moderate holism is acceptable, it is to no avail in the realist's attempt to escape the manifestation argument. Let us consider first Tennant's use of a moderate holism.

Tennant's position does indeed make use of moderate holist principles; but he makes a clear distinction between terms in the language amenable to holistic interpretation and those which still require treatment along molecularist lines. He restricts his use of holism to explaining the meaning of 'extra-logical primitives', while insisting that one remain a molecularist with respect to the logical constants. Since the debate between semantic realists and anti-realist focuses primarily on the proper interpretation of the logical constants (in particular on the correct introduction and elimination rules of the negation sign) and not on extra-logical terms, the dispute remains alive. In effect, Tennant argues that he can accept a moderate holism and *still* remain a semantic anti-realist. Consequently the semantic realist who wishes to use holist principles to escape the manifestation argument must argue that holist principles can be appropriately employed to explain the meaning, not just of extra-logical primitives, but of the logical constants as well. So why does Tennant feel that the use of holist principles must be restricted to extra-logical terms? and are his reasons compelling? To answer these questions we need to consider how logical constants get their meaning.

It is accepted by semantic realists and anti-realists alike that, although precise meanings cannot be assigned to all terms in a language

(especially natural languages), precise meanings can be assigned to the logical constants. And again there is cross-party agreement that the meanings of the logical constants are determined by their introduction and elimination rules. But having said this, it is clear that we cannot assign just any rules to a logical constant and expect it to be a useful addition to a language. Ever since Prior's discussion of 'Tonk'<sup>21</sup>, a hypothetical logical constant with the introduction rule of ' $\vee$ ' and the elimination rule of '&', it has become clear that, if a logical constant is to be an acceptable addition to a language, it must lead to a conservative extension of the set of sentences in the language that the speakers believe to be true. The problem with 'Tonk' is that its addition to a language would allow any sentence to be derived from any other sentence in the language, thereby doing away with the distinction between sentences in the language the speakers hold to be true and those they hold to be false. With this in mind we can identify three criteria which any acceptable interpretation of a logical constant must meet: a) the logical constant must be assigned a precise meaning (in terms of introduction and elimination rules) *which is learnable* (i.e. no radically holistic interpretation of the logical constants is permitted; b) one's grasp of the assigned meaning must be *manifestable in use*; and c) the logical constant must lead to a *conservative extension* of the set of sentences held to be true by the speakers of the language to which it is added.

With these criteria in mind we can now consider Tennant's claim that a moderate holist interpretation of the logical constants is not acceptable. When we compare the semantic realist's interpretation of the logical constants (an interpretation associated with the rules of Classical Logic) with that of the semantic anti-realist (an interpretation associated with the rules of Intuitionist Logic), we find that *both* interpretations meet the three criteria mentioned above, albeit in different degrees. Both schools offer interpretations of the meanings of the logical constants which are learnable, manifestable in use (if adherence to the assigned rules is taken to be adequate manifestation of one's grasp of the assigned meanings) and conservative. However, there are significant differences between the two sets of rules. In particular, the rules of Intuitionist logic are conservative in a way the the rules of Classical logic are not. The logical constants of Classical logic are said to be only 'globally' conservative (i.e., the logical constants of Classical logic are

conservative only when they are added to a language simultaneously), while the logical constants of Intuitionist logic are individually conservative (i.e., they are conservative even when added to a language one at a time). This means that the meanings of the Classical logical constants are determined not by the introduction and elimination rules of each constant taken on its own (as is the case in Intuitionist logic), *but by the introduction and elimination rules of all the constants taken together*. In other words, the logical constants of Classical logic are interpreted in a *holist* fashion. But since there are only six logical constants and twelve rules to explain their use, the Classical logician can claim that this is a manageable holism in that the meanings of the logical constants are certainly learnable.

But if the interpretation of the logical constants offered by Classical logic meet the above mentioned criteria, why should one opt for the Intuitionist logic? More to the point, on what grounds does Tennant insist that holism should be restricted to the interpretation of non-logical terms? The Intuitionist interpretation of the logical constants has two features which could recommend it. First, the logical constants of Intuitionist logic are more strongly conservative than those of classical logic; but it is far from clear why this extra conservatism is necessary to avoid the problems associated with 'Tonk'. What is more, there are no principles in natural semantics acceptable to semantic realists and anti-realists alike which would lead one to prefer an interpretation of a logical constant solely on the grounds that it is individually conservative. Second, the Intuitionists can claim to provide a theory of meaning in terms of recognitional capacities and canonical warrants rather than in terms of one's grasp of possibly verification transcendent truth conditions of a sentence. But the principles of natural semantics place no restrictions on the *manner* in which one's grasp of the meaning of a sentence is to be manifested. If the grasp of the possibly verification transcendent truth conditions of a sentence can be manifested in some overt behaviour, then the requirements of natural semantics have been met. And, as yet, no argument has been forthcoming to the effect that adherence to the rules of Classical logic does not constitute a genuine manifestation of one's grasp of a sentence in terms of its possibly verification transcendent truth conditions. Now if we are not forced to opt for the Intuitionist interpretation of the logical constants, then the fact that the Intuitionist logic leads to well-

documented counter-intuitive results ought to be grounds enough for rejecting, if not the Intuitionist project as a whole, then at least Tennant's claim that holism must be confined to the interpretation of non-logical terms. Consequently, Tennant has not offered any compelling reason to think that the semantic realist cannot legitimately employ a moderate holist interpretation of the logical constants.

But perhaps there is an argument which can be forwarded to the effect that adherence to the rules of classical logic *does not* constitute a genuine manifestation of one's grasp of a sentence in terms of its possibly verification transcendent truth conditions. The anti-realist might claim that one can replace the logical constants of Classical logic by those of Intuitionist logic without a corresponding loss of use or meaning within the language. If this substitution entails only a loss of 'talk' it could be argued that the logical constants were not doing any real work in the language game, and that the apparent understanding of verification transcendent truth conditions was illusory.

There are two responses the semantic realist can offer against this argument. The semantic realist can argue that there is no independently agreed criterion available by which to distinguish 'real use' from empty 'talk'. In fact it is not clear what empty talk might be if it is accepted that all well formed sentences in the language are understood by all competent speakers of the language. But until an explanation of what empty talk amounts to, and a mechanism to draw the distinction is available, any attempt to dictate which sentences in the language fall into which category will fail to be decisive. The anti-realist argument fails as a consequence since it depends on a distinction that cannot yet be drawn.

The semantic realist might take a softer line, however, and agree that while there is no hard and fast rule to distinguish real use from empty talk, there is a pre-theoretical intuition of what constitutes real use. But such a line is attractive to the semantic realist because our intuitions inevitably support the view that the loss of logical constants of Classical logic *does* incur a loss of real use. Adherence to the rules of Classical logic allows us to use sentences currently not known to be decidable (certain sentences about the past, other minds and regions of space-time not accessible to observation) in ways that seem to be a

natural extension of beliefs systems and theories expressed within the language, and to avoid the counter-intuitive results stemming from the rejection of the principle of bivalence. If the rules of Classical logic allow such sentences to be used within the language, and such sentences are not empty 'talk' (as, of course, the Intuitionist would not admit) then it would seem that adherence to the rules of Classical logic can arguably be taken as a genuine manifestation of one's grasp of verification transcendent truth conditions.

Now we said earlier that there are three options the semantic anti-realist might try to employ against the semantic realist's use of moderate holism. It appears as though the first option, the blocking of any use of holism whatsoever, has failed, since even the anti-realist by their own admission are forced to call upon it for their own semantics. The second option, granting access to a moderate holism but arguing that it is to no avail to the semantic realist in his attempt to escape from the manifestation argument, has also failed. This leaves the final option. We will recall that it was suggested that the anti-realist might be able to give the semantics of the disputed sentences without having to call upon holistic principles at all. This would then allow the anti-realists to claim that they are able to offer a cleaner, more manageable semantic theory that ought to be preferred to the moderate holism of the realists on these grounds alone. However, as we have seen, it is clear that the anti-realists will not be able to provide a semantic theory that is *entirely* free of holistic elements given that they admit that even a molecular semantic theory must make use of holistic principles in the case of extra-logical terms. Given that the vocabulary of most languages is made up largely of such extra-logical terms it seems unlikely that anyone, regardless of their desires for a simple, manageable semantic theory, will be able to manage without some elements of holism creeping in. But could they provide a viable semantics of the disputed sentences containing logical constants while restricting the use of holist principles to the interpretation of extra-logical terms?

A case study of the anti-realist attempt to give the semantics of currently disputed sentences may be made of Colin McGinn's well known thought experiment concerning the tree people and the correct interpretation of their sentences containing the 'south side' operator.<sup>22</sup>

McGinn, and eventually Wier, provide the traditional realist interpretations of these disputed sentences while Tennant argues that such an interpretation is not warranted and is simply an application of the realist bias. Whatever the merits of Tennant's case against the interpretation suggested by McGinn, one looks in vain among Tennant's writings for any alternative reading. This is a particularly nasty problem for the anti-realist. According to their own account, currently disputed sentences (like 'south side' sentences for the tree people) are understood by the speakers of the language. If this is the case, it is then incumbent upon any viable semantic theory to make plain in what this understanding consists. If the semantic anti-realists can do no more than reject the interpretation offered by the realists, but put nothing in its place, they cannot be said to have a viable semantic theory. But one looks in vain for this alternative.

But quite apart from the fact that no alternative reading is offered, there is also the problem of seeing just how any reading of these sentences could be achieved without employing holist principles in order to give the semantics of the disputed sentences. In order for the semantic anti-realist to provide the semantics of 'south side' sentences, sentences which were otherwise unproblematic save for the presence of the south side operator prefixed to the sentence, the anti-realist has to treat the operator as a logical constant whose meaning is determined by its individual introduction and elimination rules in the same way as any other logical constant of the Intuitionist variety. However, there has yet to be an account given by anti-realists of how this is to be possible without reference to other theoretical commitments. It seems very unlikely, to say the least, that all terms or expressions that make unproblematic sentences into disputed sentences can be treated as logical constants. Terms such as the south-side operator which apparently involve reference to inaccessible regions of space-time seem embued with theoretical commitments that make them significantly different from the logical constants of Intuitionist logic. Given the foregoing it would appear that Dummett and Tennant will have to approach the disputed sentences in much the same way as one equipped with a moderate holism on both extra-logical terms and the logical constants. Indeed, one is hard pressed to see how else the meaning of theoretical sentences could be manifested. Unless some convincing argument is forthcoming which shows that those terms that

make a sentence currently disputable can be given treatment similar to those given to logical constants, they will have to admit that these sentences are going to be members of 'local holisms' suspended in the language.

We have now reached the conclusion of this examination of the manifestation argument. What has been shown is that the disputed sentences which are the focus of the manifestation argument can be given adequate treatment according to naturalist standards if one accepts the viability of a moderately holistic view of language. The semantic anti-realists, while establishing the untenability of a thoroughgoing holism, have not provided any reason to think that a moderated holism is equally untenable. In fact we have seen that semantic anti-realists themselves, despite their fondness for molecular semantic theories, are forced to grant a place to holistic principles in their own semantic system. Consequently there seems to be no successful prevention of the realist's use of holistic principles to aid him in escaping the problems posed by the manifestation argument. Finally, the semantic anti-realists have not provided an alternative account of the semantics of the disputed sentences despite their insistence that such sentences are understood. But if Tennant's comments on the nature of extra-logical terms is anything to go by, it would seem clear that these disputed sentences will receive substantially the same treatment from both realists and anti-realists alike. Both will manifest their understanding of such sentences by making use of the speaker's ability to appreciate the relations that obtain between the sentence in question and other sentences in the same local holism. Now since semantic anti-realism is unable to clearly better semantic realism in this area, there is little or no incentive for the realist to adopt the anti-realist position with its rejection of bivalence and all the counter-intuitive problems that follow as a consequence.

### *Summary of the last two Chapters*

Let us summarise briefly what conclusions have been reached concerning the semantic anti-realist challenge to the coherence of scientific realism and anti-realism. It will be recalled that the root of the challenge was that the participants in the realist dispute in science



are both guilty of operating with an incoherent notion of truth. Putnam's argument against radical scepticism presented in the first chapter of *Reason Truth and History* illustrated precisely what consequences befall us if an epistemically constrained notion of truth is to replace that held by scientific realists and anti-realists. But his argument, based on a particular understanding of the nature of reference, was seen to be convincing only once one has adopted an epistemically constrained notion of truth. It is in the work of Dummett and other semantic anti-realists, however, that we find the core argument against the notion of truth as a possibly verification transcendent property of sentences. In this chapter we have been at pains to establish that this argument, known as the Dummettian Reductio, is not compelling. This being the case, there is no reason to opt for a notion of truth as epistemically constrained, and there is no threat to the coherence of scientific realism and anti-realism as we described them in the *Introduction*. This brings to a close the first of the obstacles facing our attempt to combine the virtues of scientific realism and anti-realism into one coherent position in the realist dispute in science.

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<sup>1</sup> W. V. O. Quine, 'Ontological Relativity' in *Ontological Relativity and Other Essays*. New York: Columbia University Press, 1968.

<sup>2</sup> Ibid., p. 27.

<sup>3</sup> Ibid., p. 26.

<sup>4</sup> Ibid., p. 28.

<sup>5</sup> 'Behaviour' is not construed here in the narrow sense of 'bodily motion' along Behaviorist lines.

<sup>6</sup> Anthony Appiah, *For Truth in Semantics*. Oxford: Blackwell, 1986, p. 74.

<sup>7</sup> In Appiah, p. 74.

<sup>8</sup> Neil Tennant, *Anti-Realism and Logic*. Oxford: Clarendon Press, 1987.

<sup>9</sup> Ibid., p. 112.

<sup>10</sup> Quine, 'Two Dogmas' in *From a Logical Point of View*. Second Edition. London: Harvard University Press, 1980, p. 43.

<sup>11</sup> Michael Dummett, *Truth and other Enigmas*. London: Duckworth, 1992, p. 377.

<sup>12</sup> Ibid., p. 377.

<sup>13</sup> In Tennant, p. 48.

<sup>14</sup> 'Original Sinn' in *Frege: Philosophy of Language*. Second edition. London: Duckworth, 1983.

<sup>15</sup> 'The Justification of Deduction' is in *Truth and other Enigmas*.

<sup>16</sup> Tennant, pp. 51-52.

<sup>17</sup> Tennant, p. 64.

<sup>18</sup> See *Truth and other Enigmas*, p. 304.

<sup>19</sup> Tennant, p. 65.

<sup>20</sup> Ibid., p. 65.

<sup>21</sup> See A. Prior's "The runabout inference Ticket", and "Conjunction and Contonktion Revisited" in *Analysis*, vol. 24, (1963/4).

<sup>22</sup> See the following articles for a continued study of Colin McGinn's 'south-side' operator and dispute over the correct interpretation of the speech of the 'tree-people'. McGinn's scenario is put forward in "Truth and Use" which appeared in *Reference*

*Truth and Reality*, edited by M. Platts. Tennant responded in *Analysis* vol. 41 (1981), with "Is this a proof I see before me?" The same volume of *Analysis* contains McGinn's "Reply to Tennant". Alan Weir came to the aid of McGinn with "Truth Conditions and Truth Values" in *Analysis*, vol. 43 (1983), to which Tennant responded in the following volume with "Were those disproofs I saw before me?" Weir, undaunted, then came forward with "Reply to Tennant", *Analysis*, vol. 45 (1985) and Tennant, not to be outdone, replied with "Weir and those 'disproofs' I saw before me" in the same volume.

## Chapter 4

### *The Problem of Demarcation*

Having dealt with the semantic anti-realist challenge, it now remains to confront the problem of demarcation. Given the desire to combine realist and anti-realist tendencies into one coherent philosophy of science, some mechanism is required by which to distinguish that area of discourse about which we can take a realist attitude from that demanding an anti-realist approach. It might be expected that a plethora of such mechanisms would litter the writings of either scientific anti-realists who are not anti-realists with respect to every area of discourse, or conversely, scientific realists who are not realists in all areas. Van Fraassen is a good example of a such a specimen, being a scientific anti-realist with semantic realist tendencies, while Hartry Field's work includes an attempt to reconcile scientific realism with mathematical anti-realism. Unfortunately, as we shall see shortly, no satisfactory solution to our particular form of the demarcation problem is to be found in the literature. It is true that some have provided a reasonable demarcation mechanism that allows one to distinguish one area of discourse from another. Hartry Field, for example, is arguably successful in his attempt to distinguish the entities of mathematics from those of the natural sciences, permitting an anti-realist reading of the former and a realist reading of the latter. However, our problem is made more delicate by the fact that we are looking to make a similar distinction *within* what has hitherto been considered one area of discourse, i.e., the natural sciences. However, discussions in the philosophy of language provide a hint as to how one might hope to unravel this particular problem. But before I proceed to outline and discuss my proposed solution it will be useful to consider how others have treated the demarcation problem in the past. This survey will underline the merits of the solution I will bring forward in the following chapters by highlighting the pitfalls past demarcation mechanisms have been unable to avoid, as well as their respective strengths. The viability of my solution will be more in evidence when these past successes and failures are clearly before us.

#### *Realism and Bivalence*

The most recent mechanism by means of which to distinguish those

areas of discourse fit for realist interpretation from those requiring an anti-realist attitude has come from the reflections of semantic anti-realists like Dummett and Tennant. It has been argued that one's stance in the realist dispute with respect to a given area of discourse ought to be determined by whether or not the principle of bivalence is appropriately applied to the sentences of that area of discourse. If the principle of bivalence holds for the sentences in question, then one can opt for a realist interpretation; if not, anti-realism is the only option.

There is clearly something to this demarcation mechanism. If the sentences of a given discourse are neither true nor false, then they cannot be considered to be stating anything about extra-linguistic reality. Usually a sentence to which the principle of bivalence does not apply is one which fails to refer to anything actually in existence - this is the traditional positions vis à vis future contingents, and arguably the proper interpretation of sentences like "The King of France is bald", and also of sentences in works of fiction. So a precondition of a discourse being a candidate for a realist interpretation is that it contain sentences that accurately or inaccurately track real facts about some aspect of extra-linguistic reality. But a question remains: how do we determine if there are such extra-linguistic facts to track at all? how do we determine when we are justified in thinking that the principle of bivalence applies?

The semantic anti-realist suggestion, well known to us from the preceding chapter, is that semantic considerations are sufficient to determine whether the principle of bivalence applies to a sentence or not. If a sentence's truth conditions are verification transcendent, then, by the rules of Intuitionist logic, we are not warranted to assume that the principle of bivalence can safely be applied to this sentence. Now we have already gone to some lengths to demonstrate that the Manifestation argument used to support semantic anti-realism is not compelling. Consequently we must say that semantic considerations of this type do not determine whether the principle of bivalence applies to a given sentence or not.

But there is a further complication to consider. It is clear that if the principle of bivalence does not apply to given discourse, then a realist interpretation of that discourse is impossible. But we are not

committed to saying that any discourse, to which the principle of bivalence applies is automatically accorded a realist interpretation. A realist interpretation of a scientific theory demands more than that theory being either true or false. Indeed, there must be facts which the theory tracks; but in addition to this, the theory must actually be true. Scientific realism, as described in the *Introduction*, involves the belief that realistically interpreted theories are true representations of some aspect of extra-linguistic reality.

Now we have found no reason as yet to assume that the principle of bivalence *does not* apply to scientific discourse. In fact the bivalence principle is more telling in those areas of discourse where it is unclear that there are extra-linguistic facts to track; for instance, it is unclear that there are moral or modal facts, mathematical or comic facts. But there is little doubt that there is an external world, and that scientific theories are in some sense 'about' this world. And since the applicability of bivalence it is not a sufficient condition of a realist interpretation of a scientific theory in any case, our operating assumption will be that the principle of bivalence *does* apply to all scientific statements, unless some over-riding consideration presents itself. This is in line with our commitment to semantic realism. We will assume, then, that all sentences purporting to be about some aspect of extra-linguistic reality are, a) *really* about some aspect of extra-linguistic reality, and hence true or false, or, b) *presuppose* other sentences which are themselves true or false. As an example of a sentence of type b) - the question of the truth or falsity of the famous sentence "The King of France is bald" presupposes the truth of a prior sentence, namely "There is a King of France". Likewise all statements describing theoretical entities presuppose that sentences to the effect that these entities actually exist are true. Our problem in the realist dispute in science, then, is not to distinguish between theories to which the principle of bivalence applies from those to which it does not, *but to distinguish between those scientific theories which can be considered to be true representations of extra-linguistic reality from those which are at best empirically adequate*. With these operating assumptions in mind let us move on to consider other demarcation mechanisms.

### *Super vs. Sublunary Worlds*

Perhaps the earliest demarcation mechanism in the history of science can be found in the work of Aristotle and the medieval scholastics who adopted his cosmology. In Aristotelian science a division was recognised between areas of the cosmos about which humans can have scientific knowledge and those areas which were thought to be beyond our epistemic capabilities. This distinction coincides with the familiar demarcation between the sublunary and superlunary worlds. Because it was believed that the heavenly bodies were composed of a fifth element thought to be radically different in nature from those encountered in sublunary objects, it was held that humans could not form adequate judgements concerning these objects. Having no direct experience of this fifth element which was thought to be divine, and thinking that no analogies could be drawn between sublunary elements and the superlunary element given the divinity of the latter, our human intellect was thought incapable of forming judgements adequate to the nature of the heavenly bodies. Now it is evident that in order for this distinction between divine and profane sections of the cosmos to be intelligible, let alone acceptable, much metaphysical and epistemological theory needs to be understood and accepted. Obviously such a mechanism is unacceptable today, as it has been ever since Galileo was able to establish that the lunar surface, being rough and uneven, betrays its terrestrial and profane nature.<sup>1</sup>

### *Ratio Sufficiens and Cognitive Command*

Odd as it may seem, dividing the cosmos into two separate spheres as the Aristotelians did may not be as ludicrous as it first appears. One might make the case that this division of the cosmos into radically dissimilar areas was used to explain certain facts that had been established in Greek astronomy. It was a common place among ancient Greek astronomers and those who followed in this tradition, as Duhem and Blumenburg and other historians of science have pointed out, that the phenomena of the skies could be saved by different and inconsistent astronomical hypotheses. To this situation we must add the fact that the other sciences, especially the natural sciences, had not reached a similarly advanced stage of development as had astronomy. The

significance of this delayed development was that the Greeks had no reason to suppose that the other natural sciences would in the course of their development eventually encounter this same under determination problem that had been recognised in astronomy. In such circumstances under determination could reasonably be thought to be the particular characteristic of astronomical hypotheses. The under determination of astronomical theory was, therefore, a reason to see astronomy as dealing with a distinct area of the cosmos, one not entirely amenable to human investigation. Against such a background it is easier to imagine how a metaphysics supporting the distinction between the sublunary and superlunary worlds would have a ring of plausibility (assuming, of course, that one is operating with a version of semantic realism).

It should also be pointed out in the interests of historical accuracy that the theory that the heavenly bodies were indeed composed of a fifth element not found in the sublunary world was not accepted by all medieval scholastics. Interestingly enough this did not stop those who rejected the idea of a fifth element from continuing to view astronomical theories anti-realistically. Indeed it was the acknowledged under determination of astronomical hypotheses that remained the principle reason for viewing astronomical hypotheses anti-realistically. Such was the view of Aquinas, who was led to consider another demarcation mechanism entirely unrelated to the question concerning the possibility of a fifth distinctly heavenly substance but wholly occupied with the problem of under determination. Aquinas maintained that scientific knowledge is achieved when one has produced a 'sufficient proof' or *ratio sufficiens*.<sup>2</sup> The peculiarity of such a proof is that it claims to establish not only *that* such-and-such is the case, but *why* such-and-such is the case. In other words, it is claimed that such a proof proports gives a sufficient explanation of a given phenomenon *in such a manner as to rule out the possibility of another explanation*. This is entirely in keeping with the Aristotelian view of knowledge as presented in the *Posterior Analytics*, an issue to which we will return in the later sections of this work. The crux of this position is that one can claim to have scientific knowledge of a particular object or phenomenon (which can be interpreted realistically) when there is no possibility of an alternative theory saving the phenomenon in question. It is easy to see the connection between this mechanism and the problem posed by the

under determination of astronomical hypotheses: that area of discourse will be viewed realistically which is not subject to the problem posed by the under determination of theory by data. One might gloss this by stating that that area of discourse will be viewed realistically *about which ultimately there can be no rational disagreement*. Once a *ratio sufficiens* has been produced all discussion concerning the conclusion of that proof ceases. Now the hypotheses of astronomy conspicuously fail to meet this requirement precisely because astronomical hypotheses are underdetermined; hence a *choice* of hypotheses is open to astronomers. Such is not the case where a *ratio sufficiens* is available. Aquinas makes this very clear in question 32 of the *Summa Theologiae*:

. . . an astronomical argument about eccentrics and epicyclic motions is put forward on the ground that by this hypothesis one can show how celestial movements appear as they do to observation. Such an argument is not fully conclusive, since an explanation might be possible even on another hypothesis.<sup>3</sup>

and in his commentary on Aristotle's *On the Heavens*:

Although these suppositions save the appearances, we are nevertheless not obliged to say that these suppositions are true, because perhaps there is some other way men have not yet grasped by which the things which appear as to the stars are saved.<sup>4</sup>

This demarcation mechanism is intuitively attractive, but it has two serious difficulties. The first criticism one must consider is that on this scheme almost nothing achieved in the natural sciences will count as knowledge that can be interpreted realistically. Such explanations may simply not be attainable in the natural sciences. This problem is one that will occupy us later when we consider Aquinas' philosophy of science in detail. For now let us just make a mental note of this difficulty, namely that perhaps Aquinas has given too much away to the anti-realists. But it is clear that Aquinas was not worried about this particular difficulty, which brings to our attention the second difficulty with this mechanism. Aquinas did not consider his standard of



scientific knowledge to be dangerously high because he thought that such proofs had already been found in the natural sciences. He believed, for example, that the proofs called upon to prove the uniform velocity of the heavenly bodies to be sufficient<sup>5</sup>. When such proofs are considered by non-Aristotelians, however, the problem is all too clear: What one considers to be a *ratio sufficiens* depends entirely on one's conceptual framework of beliefs and intellectual practices - one's paradigm, to use Kuhn's terminology. Inevitably a *ratio sufficiens* is found acceptable from *within* a conceptual framework already in place. Once the conceptual framework is challenged, however, as has happened in the case of Aristotelian metaphysics and physics, the proof is likely to lose the status as a bearer of knowledge. Of course this is not something peculiar to medieval science: all proofs or explanations which rely on one's acceptance of a highly theoretical conceptual scheme are subject to this difficulty. Nevertheless, Aquinas has identified an attractive characteristic of realist discourse, namely, the impossibility of rational disagreement within it. This is a feature of realist discourse picked up and discussed by Crispin Wright in *Truth and Objectivity*.<sup>6</sup>

Although far removed from Aquinas in time and intellectual temperament, Crispin Wright has also undertaken the task of distinguishing realist from anti-realist discourse. The interest of his work lies in the fact that he is not concerned primarily with any particular areas of discourse, as is a Hartry Field, but with the theoretical problems the attempt to draw this distinction poses. In particular it is his discussion of 'Cognitive Command' that is of interest to us since it is presented as a potential demarcation mechanism. He writes:

one might wonder whether. . . all roads to realism have to go *through* Cognitive Command - whether it is a necessary feature of any discourse about which the basic anti-realist view is to be exceeded, and is hence implicated in any sufficient case for going beyond that view. . . . If it is, then of course it becomes a point of great strategic importance for the opponent of realism: *show that a discourse lacks Cognitive Command and you blow away with one stroke all conceivable forms of realist resistance* (my emphasis).<sup>7</sup>

Such a mechanism is just the sort of thing we are looking for. It is

therefore crucial that the meaning of the term 'Cognitive Command' be examined. Wright provides the following formal account of this key idea:

A discourse exhibits Cognitive Command if and only if it is *a priori* that differences of opinion arising within it can be satisfactorily explained only in terms of "divergent input", that is, the disputants working on different data (hence *ignorance* or *error*), or "unsuitable conditions" (resulting in *inferential error*, or *slips* due to inattention, or *oversight* of data, etc.), or "malfunction" (e.g. *prejudicial assessment* of data, upwards or downwards, or *dogma*, or failings in other categories already listed).<sup>8</sup>

The gist of this position seems to be that that area of discourse exhibits Cognitive Command, and hence is at least in the running for a realist interpretation, when it is not possible for disagreements in this area to be considered justified or fully rational.<sup>9</sup> In other words, if two disputants differ with respect to some sentence in this area of discourse, at least one of the two must be manifestibly mistaken, and the mistake must be of the sort Wright enumerated. Once the mistake has been identified it is then 'irrational' not to abandon the position to which the mistake led. Wright glosses this definition by saying that disagreement in an area exhibiting Cognitive Command 'involves something worth describing as a *cognitive shortcoming*.'<sup>10</sup>

It is important to recognise that there are two distinct types of mistake that Wright appeals to in his definition of Cognitive Command. There are errors due to what he calls 'divergent input', and those due to 'malfunction'. The first sort of error stems from a failure to gather the appropriate sensory data relevant to a particular problem. This can be due to either malfunction of the requisite senses or to failure to employ otherwise sound senses effectively. The second, and arguably more interesting sort of error are those relating to the interpretation or 'assessment' of received data conducted under the influence of certain prejudices or dogma. It is in this area that the central role played by the accepted standards of rationality employed by the intellectual community becomes evident.

This reliance on standards of rationality, which are pressed into service to determine whether a disagreement is rational or not, ought to give us

pause. As noted above, disagreements can stem from two sources. Those due to sensory failure are no cause for concern. Clearly if someone overlooks relevant data, due to sensory malfunction or inattention, then their opinion on the matter at hand will be easily discounted as due to a cognitive shortcoming. But more importantly, the person in error cannot fail to appreciate this fact once the source of the error has been identified and pointed out. The same sanguine approach, however, cannot be taken so quickly when the error is of the second sort. If the error is due to a failure on the part of one of the disputants to follow accepted intellectual practices, particularly interpretative practices, one is faced with a situation where the charge of irrationality and error may with equal justice be levied by each disputant against the other. Indeed, whenever a paradigm of the sort Kuhn describes is removed and replaced by another, charges of irrationality abound until the new paradigm is sufficiently established, by which time a new standard of rational behaviour has replaced the old. One has only to recall the reception of the Copernican hypothesis by some astronomers and scientists of the day. Over fifty years after its introduction many still felt comfortable rejecting the idea of a moving earth as patently absurd. It was still termed a 'tremendous paradox' and 'an obvious piece of folly' by Domenico Bertini in his address to the Holy Office as late as 1615.<sup>11</sup> The point to underline is that by the standards of the day such a view of the Copernican hypothesis was considered fully justified and fully rational.<sup>12</sup>

Once the historical nature of standards of rationality is fully appreciated a modification of Wright's conception of Cognitive Command is required. For where Wright saw two distinct types of error, we have seen that errors of 'malfunction' come in two guises. Cognitive Command as outlined by Wright in the end reduces to three factors: a discourse exhibits Cognitive Command if disagreements in this area are due either to divergent input or inattention, to inferential malfunction, or to the failure of one of the disputants to follow the interpretative standards of the intellectual community of which he was a member. This version of Cognitive Command must be modified; indeed, the last of these criteria must be dropped. Now if we accept that standards of rationality are not fixed, and hence no sure indicator by which to distinguish knowledge from received opinion, the range of discourses likely to be candidates for our modified version of Cognitive Command is greatly reduced. In fact

we are led to conclude that a discourse in the natural sciences displaying modified Cognitive Command is likely to be of a very low order of theoretical abstraction, perhaps never rising above the level of observation sentences. (We should also point out that Wright's version of Cognitive Command must be altered in another way given our rejection of the first demarcation mechanism. Wright's distinction is used to separate those sentences which are *apt* for a truth value from those that are not; while our modified version of Cognitive Command is used to distinguish between sentences with a *determinate* truth value from those that do not.) Such a conclusion seems to be in close agreement with those philosophers of science of the 20th century who have employed the most familiar of demarcation mechanisms: the distinction between the observable and the unobservable, between observation and theory.

### *The Theory/Observation Dichotomy*

The demarcation most often drawn in 20th century philosophy of science is the well known logical positivist distinction between observation sentences and terms and their theoretical counterparts. Such a distinction also coincides with the view that it is possible to separate a scientific theory into two component parts: that part which is confined to mere *description* of the phenomena being studied, and that part containing the *explanatory models and principles* used to give order and intelligibility to the phenomena described. The hope of those at pains to draw such a distinction is to strip away the effects of theory and to produce the primordial, pristine theory-free observation language the ontology of which everyone must accept.

If such a distinction could be drawn we would certainly have a possible means of demarcation. But we have already had occasion to note the difficulties (if not the impossibility) of drawing this distinction in practice, given that observation is arguably always theory-laden. Duhem writes that this distinction

becomes infinitely delicate and thorny when it comes to a scientific fact or law. In fact, the proposition which formulates this fact or law is generally an intimate mixture of experimental *observation* endowed with objective import and

*theoretical interpretation*, a mere symbol devoid of any objective sense. It will be necessary . . . to dissociate this mixture in order to obtain as pure as possible the first of the two elements forming it; in that element, indeed in that observational element alone, can his system find confirmation or run into contradiction (my emphasis).<sup>13</sup>

Nevertheless, Duhem was still confident the distinction could be drawn. All that was required was an intimate familiarity with scientific theories.<sup>14</sup> However, Duhem has very little to offer in the way of an objective demarcation mechanism. In fact his suggestion amounts to little more than the claim that 'One develops a knack for such things'. He writes:

Very often in the report of a physical experiment, the real and objective matter and the merely theoretical and symbolic form interpenetrate each other in so intimate and complicated a manner that the geometric mind with its clear and rigorous procedures, too simple and inflexible however, to be penetrating, may not suffice to separate them. There we need the insinuating and looser methods of the subtle mind with finesse; it alone, by slipping in between this matter and form, can distinguish them; it alone can surmise that the latter is an artificial construction created of whole cloth by theory and without any value for the metaphysician, whereas the former, rich in objective truth, is suited to instruct the cosmologist.<sup>15</sup>

Although Duhem has succeeded in clearly and almost poetically expressing the difficulty of drawing this distinction, complete with the Frenchman's required allusion to Pascal, we are still left without any indication of how one might come by this 'subtle mind with finesse'. Duhem's comment is less than satisfactory:

Now, the subtle mind here, as everywhere else, is sharpened by long practice; it is by profound and detailed study of theory that one will obtain that sort of flair thanks to which one will discern in a physical experiment what is theoretical symbol, and thanks to which one will be able to separate this form, of no philosophical value, from the genuine empirical teaching which the philosopher should take into account.<sup>16</sup>

This is all very inspiring and high minded. But when embroiled in a heated debate concerning the ontological status of some controversial entity, the disputing parties are hardly likely to give way on the grounds

that the opposition has 'flair', or a certain knack for this sort of question. But let us accept for the moment that the distinction Duhem and others want to draw between observation and theory, between description and explanation, between reality and man-made constructions, is one that, if successfully drawn, could serve as an effective demarcation mechanism. Hence, we have an interesting distinction but so far no means of employing it.

### *The Passive Anatomist and the Active Butcher*

Gavin Ardley in his work, *Aquinas and Kant: The Foundations of the Modern Sciences*,<sup>17</sup> attempts to give a more precise account concerning the separation of theory and observation sentences. Ardley is keen to develop the idea that there is a fundamental qualitative distinction between the scientific method of the Aristotelian Scholastics and that of the moderns. Without going into the details and motivations of Ardley's account of the sciences we can still extract the crux of his position. Ardley argues that the sciences as practised by the medieval scholastics produced knowledge of the sort one can interpret realistically, whereas modern science, physics in particular, produces theoretical constructs which serve as instruments of prediction and control of events in nature. He uses a metaphor to characterise the two approaches, a metaphor which also sheds light on the theory/observation dichotomy. The Scholastics he likens to anatomists, whose work requires that they discover and lay bare the internal workings of organisms. The work of the anatomist is entirely *passive*, says Ardley, in that they simply reveal the structures that are to be found in nature. Modern scientists, by contrast, are likened to butchers. The work of the butcher is to reduce the carcasses of the various animals to useful, manageable portions that fit the needs of their human consumers. The point that Ardley wants to make is that butchers *actively impose* their own order and divisions onto nature rather than *passively* laying bare the structure that nature has seen fit to produce herself. Ardley writes:

The anatomist *finds* his structure, the butcher *makes* his. The one pursuit is of the real, that of which, we may say, God is the fashioner or creator. In the other case man himself is the fashioner or creator, or rather the re-creator. . . . The anatomist proceeds by recognition of what is *objectively* there,

using the senses with which he has been endowed. The activity of the butcher on the other hand is directed *subjectively*, and is literally, as well as metaphorically, the procedure of the Procrustean bed.<sup>18</sup>

The main point that Ardley draws from the distinction between a passive and active approach to nature is that only sciences of the former persuasion can be said to have any ontological significance. In other words, only the ontologies of the 'passive' sciences are subject to realist interpretation. The objects created by an active procrustean methodology Ardley likens to 'artefacts' which are in no way a part of the real world as it is in itself. The following passage conveys the flavour of Ardley's thought:

We find that man's relation to Nature has a dual character. Sometimes he is content to accept and enjoy Nature as it is. Sometimes, on the other hand, he does not embrace Nature as it is, but instead he creates for himself an artificial structure having contact with Nature at certain points, but being for the most part a sort of shadowy parallel, or substitute, for Nature. The first is the realm of the real, the second of the categorical. These categorical systems are partly the creation of individual men, and in part they are the manifestations of society. They are among the most characteristic possessions of civilised man, and their influence is all pervasive. Their dominion ranges from modern physics at the one extreme to language and law at the other.<sup>19</sup>

To pick up the thread at it was left by Duhem, Ardley seems to be suggesting that theory-free observation sentences can be distinguished from theoretical sentences by appealing to the mode of human behaviour that brought these sentences into being. If one is entirely passive in one's approach to nature, if one allows nature to imprint itself on an inactive, inert mind, then one discovers what is objectively there. If one approaches nature actively (either in the lense of imposing a structure on phenomena, as, for example, when one insists on employing a particular conceptual model during one's study, or when one approaches Nature only with an eye to how it can be bent to human needs) one produces 'artefacts', or 'categorical' sentences which have no ontological or objective import.

Such an apparently simple, straightforward position does do justice to our intuitions regarding the theory/observation dichotomy. Observation sentences are accorded a privileged position in the sciences precisely because they have been taken to be the result of nature impinging on our sense organs, a process in which we are thought to be entirely passive. The reason for the relative distrust of theoretical sentences is that they are the product of our attempts to interpret observable phenomena, a process in which we are active. But while this metaphor explains why we have considered the theory/observation dichotomy to be important, it does not go any way to helping us draw the distinction in question. The first concern is to determine how one knows when one's appreciation of Nature is entirely passive. How does one know when one's observations are not guided by our theories? Ardley gives no indication how this might be established. The only suggestion he offers is blatantly the product of professional bias. We are approaching a purely passive view of Nature, Ardley suggests, the closer we get to Aristotelianism. He writes:

. . . it is no doubt true to say that biological, geological and other such sciences are substantially descriptive and real, and in fact 'Aristotelian', while as we move away towards modern physics we enter more and more Procrustean, and consequently autonomous and 'non-Aristotelian' realms.<sup>20</sup>

The difficulty the Ardley ignores entirely is the matter of the passivity of Aristotelianism. It is just assumed that an Aristotelian ontology is a 'passive' one. After our discussions of Aristotle's fifth element the problematic nature of such a claim is only too obvious. Simply appealing to an Aristotelian ontology without further argument is quite unacceptable as a means of establishing when one has achieved a passive appreciation of Nature.

But there is a far more serious objection to be raised against Ardley's suggestion, namely, the charge that an entirely passive approach to nature is impossible. In more modern terms, Ardley has completely ignored the debate concerning the very possibility of a theory-free observation language, a possibility that strikes many as very remote indeed. Ardley simply assumes that one's theoretical commitments and conceptual scheme do not in any way inhibit one from passively experiencing Nature when one so chooses. Ardley seems to think that



one can shed at will the conceptual framework one has adopted and get an immediate grasp of the real. The point at issue, however, is whether it is not the case that at all times one's experience of Nature is conditioned by the 'categorical' structures that Ardley claims have nothing to do with the 'real'. Whether there is a theory-free observation language is a problem to which I will return shortly, for it is central to the centre of the problem of demarcation. But it is clear that it cannot be solved by a simple, straightforward appeal to his passive/active principle, or an appeal to Aristotelianism.

### *Dispensibility vs. Indispensibility*

A third author whose work touches on the demarcation problem is Hartry Field. He is one of three authors I will consider who wish to draw the reality/construct distinction but do not employ the traditional observable/non-observable distinction to further this end. In his book, *Science Without Numbers: A Defence of Nominalism*,<sup>21</sup> Field argues for an anti-realist position with respect to mathematics despite his realist stance in the natural sciences. Although we are not here concerned with the realist dispute in mathematics, the method by which Field attempts to establish his mathematical anti-realism is of interest to us. It is by drawing attention to the difference between the properties of scientific entities and those of mathematics that Field hopes to establish that the terms of mathematics have no extra-linguistic referents.

Field's most well-known opponents in this particular debate are Quine and Putnam. They have insisted upon the objective reality of numbers and other mathematical constructions on the grounds that scientists quantify over such entities in the process of making their calculations within the scientific theories themselves. More precisely, it is on the grounds that scientists *could not do without* quantifying over numbers and the entities of mathematics in the course of their own strictly scientific work that Quine and Putnam conclude that a realist stance in science necessitates a realist stance in mathematics. On the other hand, Field contends, pace Quine and Putnam, that science *can* be conducted in a realist manner without the scientists being forced to adopt a similar stance with respect to mathematics. This conclusion rests on Field's argument that mathematics has two peculiar properties

which serve to qualitatively distinguish it from the natural sciences. First, unlike scientific theories, mathematical systems as a whole are *conservative* relative to any scientific theory to which they might be added; this leads to the second difference, namely, that unlike the entities of the natural sciences, mathematical entities are theoretically *dispensable*. It is worth our while to familiarise ourselves with Field's strategy in order to ascertain whether these properties might be of use in our particular demarcation problem within the natural sciences themselves.

The key argument in the realist dispute in mathematics that Field thinks he must counter is the 'indispensability' argument from Quine and Putnam, the latter arguing from the theoretical indispensability of an entity to its actual existence. This inference from indispensability to reality is one that Field explicitly accepts.<sup>22</sup> His strategy, then, is to grant the inference from indispensability to reality, but to deny theoretical indispensability to mathematical entities. The *dispensability* of mathematical entities is then argued for on the grounds that mathematical systems as a whole are essentially *conservative* when added to a scientific theory N, whereas the addition of more scientific theoretical commitments to N is not. These differences are enough, says Field, to establish the qualitatively distinct nature of mathematical and scientific discourse.

What Field means by 'conservativeness' is the following: If any scientific theory N in conjunction with a system S will yield no more observation sentences or predictions than one could generate from N on its own, then system S is conservative relative to N. Field's claim is that all mathematical systems are conservative in precisely this sense. Mathematical systems, Field concludes, are merely convenient intellectual tools that permit one to draw out the consequences of N more quickly and easily than would otherwise be the case. But the situation is altogether different if what one adds to N is additional scientific theory. In this case the conjunction of N and the additional theoretical commitments yields more (or at least a different set of) observation statements and predictions than one could derive from N alone. Much of Field's time is then spent in demonstrating that mathematics is indeed conservative in this way. He tries to show this by stripping certain scientific theories of their mathematical garb and

showing that the set of observation sentences derivable from the theory is unaffected.

It is not my intention to pass judgement on the success or failure of Field's project, this being both unnecessary for our present purposes as well as beyond my all too limited abilities in mathematics. What concerns us here is whether there is anything we can learn from Field's mechanism of demarcation. A little reflection will show, however, that it will not suffice for our purposes in the realist dispute in science. One can agree that there is a connection between the conservative (or non-conservative) nature of a theory and the Dispensibility (or Indispensibility) of the entities named in that theory, without accepting that an entity's Dispensibility (or Indispensibility) is a guarantee of the non-existence (or existence) of the entity in question. It is not obvious that a dispensable term necessarily has no extra-linguistic referent, nor that an indispensable term necessarily has an extra-linguistic referent.

There is indeed an intuitive plausibility to the Indispensibility/reality principle. If scientists can ultimately do without mathematics, is it not because mathematics as applied to the natural sciences is simply a tool for the organisation of phenomena, whose terms are merely useful constructs rather than names for extra-linguistic 'entities'? And if we cannot do without a theoretical term from the sciences, is this not good reason to think it is because this term has an extra-linguistic referent? And yet the fact that a term is deemed dispensable may tell us more about a thinker's metaphysical commitments than anything else. Indeed we have had occasion to note in the *Introduction* the work of certain modern analytic philosophers of logic who have attempted to dispense with terms for all manner of three dimensional enduring objects (thing-concepts) by reinterpreting them as mere concatenations of sensible properties with no underlying substance to unify them. Indeed there is nothing to stop us from attempting to do away with much more than mathematics. But unless we are forced to accept a thoroughgoing phenomenalism, we must suspect that Dispensibility is as likely to be an indication of what a thinker is willing to do without as it is a sign of what constitutes reality. Moreover, if we have decided that neither extreme in the realist dispute in science is likely to be satisfactory, we must reject any demarcation mechanism that leads to one extreme or the other.

As for a term's Indispensability, we must be alive to the fact that the theoretical indispensability of an entity is as much a function of the state of our theoretical development as it is an indication of the ontological status of the entity in question. If a term  $x$  is deemed indispensable to a particular theory  $N$ , all we may be able to conclude is that, at present, we know of no other way of generating the set of observation sentences to which we are committed by the acceptance of  $N$ . What this means is that at any moment in the history of science we may be working with entities that are indispensable *pro tempore* without there being any guarantee that the entities we have postulated actually exist. This point becomes patently clear after the briefest of studies in the history of science, which is littered with discarded entities once thought indispensable. We must conclude, therefore, that the dispensable/indispensable criterion which has animated the realist dispute in mathematics will not serve as an appropriate demarcation mechanism within the natural sciences themselves.

### *Causal Efficacy*

Nancy Cartwright has forwarded another demarcation mechanism in *How the Laws of Physics Lie*,<sup>23</sup> based on the distinction between entities assigned a causal role in explanations and those introduced as heuristic devices. Such a distinction does justice to our pre-theoretical intuition that there is a significant difference between terms for unobservable entities like 'force' as applied in mechanics, and 'virus' as employed in pathology. The former concept arguably is a heuristic device introduced to aid our understanding of certain abstract relations, while the latter, being assigned a clear causal role, is taken as naming a real entity. We cannot, of course, do justice to her whole account here, but again this is not necessary for our purposes. I will, therefore, limit my remarks to those aspects which have a direct bearing on the demarcation problem.

Cartwright begins her discussion of the realist dispute in science by distinguishing two types of scientific law. According to Cartwright, there are phenomenological laws, the principle characteristics of which are their descriptive nature, and their applicability to particular events

and processes, and theoretical laws, by which she seems to mean rather general abstract equations which are not about 'any particular happenings in any particular circumstances'.<sup>24</sup> These theoretical laws, she claims, differ from the phenomenological laws in two interesting ways. First of all, they are given an explanatory role rather than being confined to mere description. Secondly, Cartwright argues that these laws when applied to individual particular events and circumstances prove to be woefully inadequate and can only be saved by extensive use of *ceteris paribus* clauses.

At first sight Cartwright's distinction between descriptive and explanatory laws seems to be a rough correlate of the theory/observation dichotomy. But Cartwright's originality lies in that her distinction in no way depends upon the observable/unobservable distinction that positivists and instrumentalists have employed in the past. In fact in her introduction to this work Cartwright explicitly states more than once that she rejects this distinction altogether. This brings us to the most interesting feature of her approach to the realist dispute, namely, her attitude vis à vis scientific entities.

The objective reality of an entity, Cartwright claims, has nothing to do with its being observable or not (a point with which our anti-realist is in complete agreement). The entities of physics, she argues, are simply not the sorts of things one can observe. This necessitates the finding of another mechanism by which to determine the ontological status of a given entity. Cartwright thinks she has found such a mechanism in the role an entity plays in an causal explanation. By employing this criterion Cartwright feels she can justify a realist stance vis à vis certain unobservable entities, causal processes, as well as the set of phenomenological laws, while remaining an staunch anti-realist with respect to theoretical laws, which seem to encompass both highly abstract equations and theoretical models. Just how she does this is, of course, a matter of some interest to us. In particular it is her realism concerning theoretical entities that is most important. (Just how Cartwright is able to be a realist about theoretical entities and an anti-realist about theoretical laws is a problem, but not one that will occupy us here. As Van Fraassen has pointed out, this is a particularly thorny problem given that theoretical laws are statements about the properties of theoretical entities. However, I am not concerned with the general

viability of Cartwright's account, only with that of her criterion for determining the ontological status of an entity.)

As said above, Cartwright distances herself from positivists and instrumentalists who, she feels, lay too much emphasis on the observable/ unobservable distinction. What strikes Cartwright as more important is not whether an entity can be observed or not, but whether an entity is a component of an accepted causal explanation. She writes:

Suppose we describe the concrete causal process by which a phenomenon is brought about. That kind of explanation succeeds only if the process described actually occurs. To the extent that we find the causal explanation acceptable, we must believe in the causes described.<sup>25</sup>

Let us leave aside the question of whether an explanation can 'succeed' or be 'acceptable' without being true and grant, for the sake of argument, that a true causal explanation requires that we be realists about the entities referred to in the explanation. With this granted, Cartwright has no qualms about accepting the objective reality of the most speculative and theoretical entities of the new physics, provided they meet this criterion:

We can believe in the unexpected entities of quantum electrodynamics if we can give them concrete causal roles; and the rationality of that belief will depend on what experimental evidence supports the exact details of those causal claims.<sup>26</sup>

With this criterion in hand Cartwright is ready to defend her realist stance vis a vis theoretical entities. However, there is a further requirement which brings to light the inherent difficulty of this mechanism. She writes:

Causal reasoning provides good grounds for our beliefs in theoretical entities. Given our general knowledge about what kinds of conditions and happenings are possible in the circumstances, we reason backwards from the detailed structure of the effects to exactly what characteristics the causes must have in order to bring them about. . . . But it is right only if we are very careful about what makes a cause 'likely'. *We must have reason to think that this cause, and no other, is the only practical possibility, and it should take a good deal of critical experience to convince us of this* (my

emphasis).<sup>27</sup>

This causal reasoning is reminiscent of the inference to the best explanation in that an explanation is given the nod insofar as it is deemed to be the most 'likely'. But Cartwright, following Van Fraassen, explicitly rejects this form of argumentation when she says that explanatory power is no guarantee of truth.<sup>28</sup> If we are to take Cartwright at her word we are led to conclude that what we have here is not so much an appeal to the validity of this mode of inference, but a return to Aquinas' desire for a *ratio sufficiens*. Cartwright's language betrays her hope of side-stepping the under determination problem by finding explanations so conclusive as to effectively eliminate all practical possibility of alternative accounts being forwarded. Once such an account is found (not just to 'best', but the only likely account), one would be free to say that any and all entities referred to in such an explanation demands a realist interpretation.

The problem with this mechanism is that it suffers from all those difficulties that beset Aquinas' *ratio sufficiens*. This standard of knowledge is simply too high because alternative explanations always exist; hence too much is given away to the anti-realist. One might argue, however, that it is not always the case that other 'likely' explanations are ready to hand. Two points need making here. First, the absence of available alternatives does not argue in favour of the impossibility of alternatives being found; nor does it establish the truth of the one available explanation, although it does suggest that it ought to be the one adopted for the practical purposes of research. Second, all sufficient explanations are relative to an historical conceptual framework. In other words, what appears 'likely' is not fixed, one's notions of 'likelihood' and 'possibility' depending as they do on the state of one's theoretical development and the conceptual framework being employed.

I am in sympathy with Cartwright's distrust of theoretical laws which are pressed into service as explanatory principles, since I am suspicious of all explanatory components of any scientific theory. Consequently it is not surprising that Cartwright's faith in the reliability of causal explanations as decisive method of deciding ontological questions seems to me open to serious objections. This is not to insist, however, that

everything that objectively exists must be observable, or found in the purely descriptive component of a scientific theory; Cartwright is correct in abandoning this idea. I am merely stating that it is not safe to assume that an entity that has been assigned a role to play in a causal explanation need exist.

### *Physical Operations*

In Bridgeman's *The Logic of Modern Physics*,<sup>29</sup> we find yet another mechanism for distinguishing the realist area of discourse from that requiring an anti-realist attitude. In chapter two of this work Bridgeman proposes a rule that would allow one to distinguish real things from logical constructs. He writes there are in fact two sorts of constructs:

. . . those to which no physical operations correspond other than those which enter the definition of the construct, and those which admit of other operations, or which could be defined in several alternative ways in terms of physically distinct operations. This difference in character of constructs may be expected to correspond to essential physical differences and. . . are much likely to be overlooked in the thinking of physicists.<sup>30</sup>

Bridgeman insists upon the importance of maintaining this distinction. He writes:

The moral of all this is that constructs are the most useful and even unavoidable things, but that they may have a great many dangers, and that a careful critique may be necessary to avoid reading into them implications which may most profoundly affect our physical outlook and course of action.<sup>31</sup>

That Bridgeman is entirely correct concerning the importance of examining our constructs with an eye to determining what physical entities if any correspond to them I think all will admit. But again our problem is to determine whether we have here a mechanism that will enable us to carry out such a critique of our constructs. Again I think there are grounds for reservation. Bridgeman was working at a time when the scientific empiricists were struggling to produce a theory of



meaning for terms for which there was no observable referent. Bridgeman was trying to save the meaningfulness of a range of useful scientific terms for which no clear referent was available, terms like 'stress', 'mass', 'atom', 'electric field', etc. Bridgeman tried to define such terms by equating their meaning with the physical operations that accompanied the term in the theory in which they were embedded. For example, a term like 'mass' would be defined with reference to those procedures employed to determine the 'mass' of a given object. Those procedures would be the meaning of the term 'mass', at least in that instance.

The many difficulties which have been identified with Bridgeman's operational procedure are well documented and are not strictly our concern. Our problem with Bridgeman's demarcation mechanism springs from the limited range of terms to which this criterion can be applied. What single physical operation could correspond to those terms referring to middle-sized, three dimensional enduring objects? Bridgeman's answer would undoubtedly be that no physical operations are required in order to define such terms because they have a clearly observed reference, and hence a sufficiently clear stimulus meaning. These terms are not the sort of construct, if constructs they be, that have given scientific empiricists semantic difficulties. To seek to apply the operational mechanism to such terms would simply be misguided.

The difficulty with such an answer is that it assumes too much theory; in particular, it is already committed to the 'thing-hypothesis'. The positivisticly inclined empiricists and phenomenologists in both the analytic and continental traditions have gone to great lengths to rid their thinking of anything that smacked of 'metaphysics'. Thinkers like Mach, Quine and Russell carry their empiricism to such lengths that even such everyday objects as tables and chairs are considered to be theoretically constructed objects. Our senses present to us, as James would say, nothing more than a 'blooming, buzzing confusion'. It is in order to deal with this primordial sensory confusion that we construct what become the three dimensional objects that endure through time that make up the furniture of our ordinary experience. These objects, Quine suggests in his essay *Posits and Reality*,<sup>32</sup> are as theory-laden as molecules and atoms. It should be said immediately that Quine's point is not that we should lose faith in the reality of middle size dry goods.

His point is rather that if we are comfortable being realists with respect to tables and chairs, cats and dogs, then we should be equally comfortable being realists about molecules and atoms. Both sets of entities are human constructs that help us to cope with our field of experience. The point as far as Bridgeman's operational mechanism of demarcation is concerned is that this mechanism will only deal with a limited range of constructs and leave untouched a whole range of constructs for which the same question arises. Essentially, Bridgeman starts the realist dispute at an excessively high level of abstraction in our language, and consequently assumes too much theory. The debate actually begins at a much lower level, with the thing-hypothesis.

We have now considered a number of suggested demarcation mechanisms. While there are sure to others that have been neglected, I think this set gives us a good appreciation of the sorts of difficulties we face when trying to combine realist and anti-realist tendencies in a single, coherent philosophy of science. It is time, then, to summarise the lessons of this study in preparation for the introduction of my proposed solution. But these are tasks for the next chapter.

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<sup>1</sup> Galileo Galilei. *Sidereus Nuncius*. Translated by Albert van Halden. Chicago: University of Chicago Press, 1989, p.11. Although Galileo's work did much to drive home the fact that the heavenly bodies were not in fact radically distinct in nature, the idea of the common nature of the sub and superlunary worlds did not originate with him. Thorndike has pointed out that Alexander Neckham in the 12th century was well aware of the mountainous nature of the lunar surface. Far from seeing the heavenly bodies as divine, Neckham went so far as to attribute to them a sinful nature. See Thorndike, *A History of Magic and Experimental Science*. London: MacMillan and Co. 1923, Vol. II, p.192.

<sup>2</sup> Hans Blumenburg. *The Genesis of the Copernican World*. Cambridge, Mass.: MIT Press, 1987, p.192.

<sup>3</sup> Sicut in astrologia ponitur ratio excentricorum et epicyclorum, ex hoc quod hac positione facta possunt salvari apparentia sensibilis circa motus coelestes; non tamen ratio haec est sufficienter probans, quia etiam forte alia positione facta salvari possent. *Summa Theologiae*. I, q. 32, a.1, ad 2.

<sup>4</sup> Licet enim talibus suppositionibus factis, apparentia salvarentur, non tamen oportet dicere has suppositiones esse veras; quia fortasse secundum aliquam alium modum, nondum ab hominibus comprehensum, apparentia circa stellas salvantur. *Commentaria in libros Aristotelis de caelo et mundo*, II, 17.

<sup>5</sup> Blumenburg, p. 192.

<sup>6</sup> *Truth and Objectivity*. Cambridge, MA: Harvard University Press, 1992.

<sup>7</sup> *Truth and Objectivity*, p. 52.

<sup>8</sup> *Ibid.*, p.52.

<sup>9</sup> A prime example of such a discourse is arithmetic. Any disagreements in arithmetic are due to one of the disputants not appreciating some relevant aspect of

the matter in question, be it the meanings of terms or the failure to follow certain governing computational procedures.

<sup>10</sup> *Truth and Objectivity*, p. 52.

<sup>11</sup> Pierre Duhem. *To Save the Phenomena*. Chicago: University of Chicago Press, 1969, p. 107.

<sup>12</sup> It should be noted, however, that this reaction was confined to those who insisted on a realist interpretation of astronomical hypotheses. The Copernican revolution was *not* received in a similar fashion by those who confined themselves as astronomers to developing more accurate and convenient calculi. To those of this school the 'rationality' of the Copernican hypothesis was not an issue.

<sup>13</sup> Pierre Duhem. *The Aim and Structure of Physical Theory*. Princeton: Princeton University Press, 1954.

<sup>14</sup> *Ibid.*, p. 292.

<sup>15</sup> *Ibid.*, p. 293.

<sup>16</sup> *Ibid.*, p. 293.

<sup>17</sup> Gavin Ardley. *Aquinas And Kant: The Foundations of the Modern Sciences*. London: Longmans, Green & Co. 1950.

<sup>18</sup> *Ibid.*, p. 6.

<sup>19</sup> *Ibid.*, p. 12.

<sup>20</sup> *Ibid.*, p. 45.

<sup>21</sup> Hartry Field. *Science Without Numbers: A Defence of Nominalism*. Oxford: Basil Blackwell, 1980.

<sup>22</sup> Field writes: 'Subatomic particles are theoretically indispensable. I believe that that is as good an argument for their existence as we need!' p. 8.

<sup>23</sup> Nancy Cartwright. *How the Laws of Physics Lie*. Oxford: Clarendon Press, 1983.

<sup>24</sup> *Ibid.*, p. 9.

<sup>25</sup> *Ibid.*, p. 4-5.

<sup>26</sup> *Ibid.*, p. 8.

<sup>27</sup> *Ibid.*, p. 6.

<sup>28</sup> *Ibid.*, p. 4.

<sup>29</sup> Bridgeman. *The Logic of Modern Physics*. New York: MacMillan & Co., 1927.

<sup>30</sup> *Ibid.*, p. 60.

<sup>31</sup> *Ibid.*, p. 60.

<sup>32</sup> In R. Grandy. *Theories and Observation in Science*. Prentice Hall, 1973. Harré makes a similar point when he says that the use of thing-concepts presupposes a whole series of metaphysical commitments. See his *The Philosophies of Science*, Oxford: Oxford University Press, 1972, p. 20 and chapter 4.

## Chapter 5

### *Reflections on the Demarcation Mechanisms*

In the last chapter our attention was focused on the particular shortcomings of each demarcation mechanism considered. Now I turn to what can be learnt from consideration of the mechanisms as a whole. In particular I am most concerned to isolate those features which must be incorporated by any viable demarcation mechanism. Once these features are identified we can outline the nature of our own demarcation mechanism.

The principal lesson to be culled from our brief study (apart from the recognised precondition of the applicability of bivalence) is that point upon which Aquinas, Crispin Wright and Nancy Cartwright were all agreed. These three authors all state, explicitly or otherwise, that a theory worthy of a realist interpretation must avoid the problem posed by under determination. Although we do not necessarily find in their writings the language of a Van Fraassen, it is easy to see that there is general agreement that so long as a theory is under determined the most one can claim for it is 'empirical adequacy'. One can restate this view in the modified language of Wright by stipulating that any discourse in the running for a realist interpretation must display that feature termed 'Cognitive Command'. As noted earlier, the insistence on 'Cognitive Command' is another way of expressing the view that, ultimately, there ought to be no room for rational, or justifiable disagreement about the truth value of sentences in a discourse about which a realist interpretation is taken. The element of *choice* found to characterise the situation in which the astronomer finds himself vis à vis astronomical hypotheses is precisely that which Aquinas, Wright and Cartwright are insisting much be avoided at all costs.

The next lesson to emerge, again from our study of these three authors, concerns the sorts of discourses likely to be successful candidates for Cognitive Command. We saw in the case of Aquinas, and more precisely in our study of Wright, that Cognitive Command is not readily attainable for any discourse marked by a high degree of theoretical

abstraction. In the language of Wright, disagreements arise from either 'divergent input', or from what I will call '*interpretative malfunction*'. Now, as we saw, disagreements of the latter persuasion have the unfortunate quality of not being readily resolvable simply by reference to a common standard of rationality. This was due precisely to the fact that no such common standard need exist between all disputants. In such cases either party to the dispute can uphold the rationality of his position and claim his opponent is in error, thereby creating an argumentative stalemate. The important implication of this loss of Cognitive Command for such discourses is that we must approach all theory with a high level of suspicion as being unsuitable candidates for realist interpretation.

This mistrust of theory leads to two important conclusions. The first is obvious: a discourse about which a realist interpretation is possible must be of a low level of theoretical abstraction. This is a fundamental point that cannot be forgotten or overemphasised. The second bears more directly on the nature of the demarcation mechanism we are looking for. If we are animated by a mistrust of theory it is only sensible to insist that the acceptability of the demarcation mechanism not be determined by previously adopted theoretical and ontological commitments alone. In other words, it will not do to accept that demarcation mechanism which happens to make a cut which suits our theoretical position. This leads to the following delicate problem: if a demarcation mechanism is not to be chosen in accordance with one's theoretical commitments, and we accept that there is no theory-free observation language, let alone a theory-free conceptual scheme, how is the choice of demarcation mechanism to be justified? How can our choice of demarcation mechanism ever be uncontaminated by our theoretical commitments?

We will recall that Quine and Putnam maintain that objects are relative to conceptual schemes. Given this relativity, there is no guarantee that objects recognised by those operating with conceptual scheme A will be recognised by those operating with conceptual scheme B, and vis versa. But what if some objects are found in all conceptual schemes? Would these objects not be *independent* of any parochial conceptual scheme?

And would this independence not justify our conferring upon these objects a particular status given that they can take their place in all conceptual schemes? And would the demarcation mechanism that identifies such objects, should they exist, not be supremely well suited to our needs? Now I suggest that we would be justified in treating in a realist fashion sentences whose terms refer to objects which are able to take their place in all conceptual schemes, and in claiming that the mechanism by mean of which we identify such objects is free of contamination by any one *parochial* conceptual scheme.

We are now in a position to formulate an idea of the sort of discourse we ought to be seeking and the principal characteristic of the demarcation mechanism that will produce this discourse. What realists require is a particular conceptual scheme which includes an ontology, the properties of the various entities of that ontology, and a set of intellectual practices or norms governing modes of inference. But what will distinguish this conceptual scheme from all others is that it will limit itself to those features *common to all conceptual schemes*. Our guiding question must be: What are those elements that all conceptual schemes *must* employ, and about which there is no rational disagreement? In other words, what are those features of conceptual schemes which enjoy a peculiar form of Cognitive Command? It is this *species specific* conceptual scheme that realists must identify.

Note that I am not seeking an 'objective' conceptual scheme. We hope in vain for such a thing, as we do for a completely theory-free observation language or knowledge of things-in-themselves. We are only able to know and represent in our language entities and their properties insofar as they affect us, insofar as they impinge upon our particular set of sensory organs. As members of a particular species, we come equipped with a species specific sensory apparatus which, in a manner analogous to the Kantian categories, forms the framework of our perceptions of the world around us. This being unavoidably the case, we cannot hope to be any more objective than our sensory apparatus permits. But what we can postulate is a hierarchy of sentences in our language reflecting the degree of 'theory-ladenness' of each sentence. In the first class we have that set of sentences reporting

on a purely uninterpreted reality, sentences that simply 'tell it like it is'. Strictly speaking, this set of sentences is empty. In the second class we have those sentences reporting on a *relatively* uninterpreted reality. These are the target sentences of our species specific conceptual scheme, and those about which, I will argue, a realist interpretation is possible. In the third class are those sentences reporting on a relatively interpreted reality. Such sentences contain references to objects found only in parochial conceptual schemes, and are amenable to only an anti-realist interpretation. Finally, one might postulate a set of sentences with no ontological import. These are sentences to which the principle of bivalence does not apply.

It still remains to discuss how these distinctions are to be drawn. It is here that I must begin my comments on discussions in the philosophy of language surrounding the problem of *radical translation*. I propose to treat in a realist fashion those sentences containing reference to objects whose linguistic signs *cross translation determinately*. The peculiar feature of such objects, I suggest, is that they are *independent* of any parochial conceptual scheme because they are able to take their place in *all* conceptual schemes, as demonstrated by the determinate translatability of their linguistic counterpart. What the set of such objects amounts to is what one might call the 'highest common denominator' of possible ontological and conceptual schemes.

The implication of this is that all commitments to sentences containing reference to objects whose linguistic counterpart do not cross translation determinately are immediately classed as relative to a local, historical, parochial conceptual scheme. Commitments in this area, which I would suggest are inevitable, and more importantly, not to be avoided, inevitably involve an inference to the best available explanation. But as we noted in the preceding chapter, and in our opening discussions of the realist dispute in science, best explanations are always 'best' relative to an historical conceptual scheme. This being the case, caution and modesty demand that an anti-realist perspective be taken vis a vis such explanations.

The remainder of this study will be devoted to the exposition and

defence of this demarcation mechanism based on radical translation. In so doing the connections with Aristotelianism, and, consequently, with Aquinas' philosophy of science, will begin to emerge. The merit of my demarcation mechanism is that it treats each conceptual scheme and each ontological claim with as much impartiality as one can expect *because it is in instances of radical translation that our parochial conceptual scheme is of necessity laid to one side.* The 'core' ontology that results I will argue is composed of what one can term Aristotelian substances. Our interest will then turn to the shape and character of the philosophy of science that confines itself to the investigation of such an ontology. Such a philosophy is that of Aquinas. But before these matters can be explored, problems relating to Quine's famous thesis, the indeterminacy of radical translation, must be treated in full.



## Chapter 6

### *On the Indeterminacy of Radical Translation*

We must begin our discussion of our demarcation mechanism with an examination of the circumstances in which a linguist finds himself when faced with the challenge of translating a radically unfamiliar language. Donald Davidson has argued that a linguist's ability to successfully translate the speech of someone using such a language depends in part upon his ability to master a particular skill, namely, simultaneously guessing what the speaker of the target language believes to be true and what his sentences mean.<sup>1</sup> The rationale behind this statement is that the linguist cannot determine what the speaker means without knowing what he believes; and conversely, the translator cannot determine what the speaker believes without knowing what he means. It follows that in the initial stages of the translation process, i.e., when the linguist does not yet understand what the speaker means to convey by his utterances, the translator is forced to posit a number of sentences he *assumes* the speaker believes. Without this initial attribution of beliefs to the speaker the translator cannot break into the hermeneutic circle. For the linguist begins his work by assigning meanings to the speaker's utterances in such a way as to maintain as much agreement as possible between the speaker's sentences and this initial set of attributed beliefs. He will not, for example, interpret a given utterance in such a way as to imply that the speaker believes something patently false. Of course subsequent experience is likely to demand that this set of attributed beliefs be altered. Nevertheless, without this initial attribution of beliefs the translation process cannot begin.

The matter of philosophical interest for us, however, is the character of this initial set of attributed beliefs. Implementation of Davidson's principle of charity leads the linguist to two general conclusions on this matter. In the first place, the linguist ought to attribute only 'plausible' beliefs to the speaker. Davidson writes that the translator's interpretations of the speaker, his 'acceptable determinations of meaning', are 'limited by general psychological principles upon intelligible ascriptions of belief.'<sup>2</sup> Secondly, it is assumed at the outset

that the speaker's individually 'plausible' beliefs are organised into a relatively coherent system or framework. Hence it is assumed both that the speaker is not given to believing obviously false sentences, and that he has some idea of logical relationships which determine how the framework of beliefs is to be constructed. But how does the translator decide what counts as a 'plausible' belief? How does he decide what set of beliefs to call upon in the initial stages of translation?

Quine has much to say on this matter. In his *Philosophy of Logic* he writes:

It behooves us, in construing a strange language, to make the obvious sentences go over into English sentences that are true and, preferably also obvious.<sup>3</sup>

Quine gives, 'It is raining', as an example of an obvious sentence. Such a sentence is thought to be obvious because, Quine says, everyone who understands English will assent to it in the appropriate circumstances. Quine calls this type of obvious sentence an 'occasion' sentence, by which he means sentences to which everyone will assent given the proper occasion or circumstances. Such sentences contain terms which have what he calls a clear 'stimulus meaning'. It is when the appropriate stimulus impinges upon one's sensory apparatus that one has the appropriate occasion to assent to sentences like 'It is raining'. Since linguists want to attribute only 'plausible' beliefs to the target language speaker, occasion sentences, being not just plausible but obvious, are ideally suited to the needs of the translator trying to break into the hermeneutic circle.

Quine makes another interesting comment worth noting which indicates the sorts of sentences the linguist *ought not* to employ in the opening stages of translation. In *Word and Object* Quine has this to say about theoretical terms, in particular, those of the sciences:

terms of systematic theoretical science have no socially constant stimulus meaning to govern their use; [sentences containing such terms are] commonly useless in the role of occasion sentence.<sup>4</sup>

That such sentences would be useless as occasion sentences is readily understandable. When confronted with a strange language one must begin by learning the terms for objects with clear, unambiguous stimulus meanings, objects, that is, which are immediately apparent to both linguist and speaker. Now the reason simple occasion sentences containing terms referring to middle size three dimensional objects are suited to our linguist's needs is that they are likely to be members of that set of sentences I characterised as reflecting our relatively uninterpreted reality. Regardless of the differing theoretical commitments embodied in two radically different conceptual schemes, the users of these schemes cannot fail to have in common the brute surroundings in which they find themselves. Stimulus is common to all, if interpretation of that stimulus is not. Translation itself depends for its very possibility on there being this relatively uninterpreted reality which is experienced by all in much the same way. If this common ground did not exist there would be no way for the translator to break into the hermeneutic circle. The point of interest for us, however, is that this relationship can be exploited. *We can determine whether a given sentence reflects something of this relatively uninterpreted reality if the sentence can serve as an occasion sentence in the initial stages of translation.* In the interests of terminological convenience I will say that these sentences contain terms referring to object which 'cross translation determinately'. And as stated in the last chapter, I suggest that such objects are Aristotelian substances, or middle size, three dimensional objects that exist in space and through time.

But there is a difficulty which threatens to complicate our relatively simple solution to the demarcation problem, however, viz., Quine's indeterminacy of translation thesis. If Quine is correct, we have no right to claim that the terms referring to the three dimensional objects I have mentioned do indeed cross translation determinately. (It is important to recognise that his obvious sentence 'It is raining' does not contain reference to a particular object which is raining.) What this suggests is that despite the fact that occasion sentences containing reference to three dimensional objects can be employed in the early stages of translation, a point Quine does not dispute, we are in no position to claim that the objects picked out by the terms in our

sentences correspond exactly to the objects picked out by the target sentences. In other words, we have no grounds for claiming that the three dimensional objects I referred to belong to all conceptual schemes even though they are indispensable to the process of translation in the initial stages. In fact, given the indeterminacy of translation, the three dimensional objects of our home language may find no place whatsoever in a foreign conceptual scheme. What is more, Quine argues that our 'objectifying tendency' may not be 'an invariable trait of human nature'.<sup>5</sup> So it is not just that other conceptual schemes might have a different set of objects; they might not have any three dimensional objects at all.

These claims are of great importance to us, for if objects themselves are constructs, as Quine suggests, then a realist interpretation of them will have to be forgone. However, the thesis that our objectifying tendency may be peculiar to our conceptual scheme alone suffers a set back if we can show that determinate translation is attainable in the case of occasion sentences containing reference to three dimensional objects. This is the task of this last study. We must show that our objectifying tendency is an invariable human trait by showing that these objects *do* cross translation determinately, thereby establishing their independence from any one parochial conceptual scheme. But before we can proceed with this task it is best to start with a thorough presentation of Quine's argument for the indeterminacy of translation.

Quine's argument for the indeterminacy of translation relies on certain assumptions to which I have already alluded. Quine opens 'Speaking of Objects' by remarking that those operating with our conceptual scheme:

persist in breaking reality down somehow into a multiplicity of identifiable and describable objects, to be referred to by singular and general terms.<sup>6</sup>

To our immediate question, 'Is this multiplicity of objects relative to a particular conceptual scheme?', Quine answers that this 'objectifying pattern' might not be an invariable trait of human nature, implying that the set of objects into which reality has been broken down could be

constructed and not discovered. Furthermore, Quine says that when we come to translate a foreign language in which a different conceptual scheme finds expression:

we are bound to adapt [this] alien pattern to our own in the very process of understanding or translating alien sentences.<sup>7</sup>

This 'objectifying pattern' is then doubly pernicious. First it leads us to construct rather than discover a set of objects out of the blooming, buzzing confusion; then we are prevented from considering any other approach to reality because all foreign conceptual schemes are inevitably cast in the structures of our 'mother' scheme in the process of being understood.

Quine's illustrates this procrustean habit of translators by highlighting the difficulties they encounter when faced with simple target sentences like 'Gavagai'. To take Quine's famous example: while at work gathering what he calls 'stimulus meanings', a translator happens upon the term 'Gavagai' which, Quine says, inevitably promotes assent among the target language users when they are in the presence of rabbits. The translator then quite properly construes the term 'Gavagai' as meaning 'Rabbit', or, 'Lo, a rabbit' since all three expressions have the same stimulus meaning. But it is here that Quine enters with his views on our objectifying tendencies. If the linguist equates 'Gavagai' with our term 'rabbit'; if he should think that 'rabbit' determinately translates 'Gavagai', then he is imposing our objectifying pattern on the foreigner without justification.

Quine's reason for suspecting that the linguist may be guilty of imposing our objectifying pattern onto the target language stems from the alleged indeterminacy of the stimulus meaning of 'Gavagai'. It is here that Quine's argument really begins. Quine's argument is that, although for all practical purposes the linguist is correct to translate 'Gavagai' by the term 'rabbit', 'Gavagai' is in fact also stimulus equivalent to 'rabbit parts', 'rabbithood', and even the unlikely 'it rabbiteth'. Therefore Quine concludes that it is quite illegitimate to immediately assume that 'rabbit' is intended rather than 'rabbiteth' or

any of the other candidates. Quine sums up his worry in the dictum: Reference is behaviourally inscrutable. It is necessary to recall that Quine is a committed proponent of the school of naturalism in semantics: all meaning must be expressible in, and gatherable from, publicly observable linguistic and bodily behaviour. Quine's claim is that from the speaker's *behaviour*, linguistic or otherwise, the linguist is unable to determinately decide whether the foreigner is referring to rabbits or rabbit parts, etc.

The next step in Quine's argument follows from the inscrutability of reference. In the process of translating a strange language the linguist must make good guesses as to what to count as nouns, verbs, particles, predicates etc. As already noted, the translator must make the intelligent guess that 'Gavagai' is equivalent to 'rabbit' and not one of the other candidates. This guess work has two consequences. First, what seems an intelligent guess will unavoidably depend on the linguist's own conceptual scheme. The result is that the linguist inevitably forces the target language into the grammatical categories of the home language in the very attempt to make the target utterances intelligible. The second consequence is just as serious. Quine argues that much of the translation manual the linguist will produce is quite arbitrary. Since the linguist has only the underdetermined stimulus meanings to go on there is inevitably a degree of *creative interpretation* involved in the linguist's work. This creativity on the part of the linguist means that it is theoretically possible to have two mutually inconsistent translations of the same target language both of which satisfying all relevant empirical constraints.

Quine adds to his case by isolating a contributing factor to, if not the principle cause of, the inscrutability of reference. He states that in order for one to be sure that another language user is actually referring to a particular discrete object one must be assured that the language user has a competent grasp of what Quine calls 'the apparatus of individuation' of the particular language being employed. The terms and grammatical devices that make up this apparatus of individuation allow a speaker to signal to an interlocutor that he is differentiating between the various objects he wishes to speak about. Quine illustrates

the importance of this apparatus by pointing out that we cannot determine if a child knows the difference between terms for individual things, mass terms, or terms for properties or predicates until the child has mastered the apparatus of individuation. Quine argues that a child can use terms like 'mum', 'water', and 'red' without knowing our conceptual scheme of 'mobile, enduring physical objects'. It is not until the child uses terms like 'apple' that our uncertainty can be dispelled. To use the term 'apple' correctly the child must appreciate the difference between expressions like 'that apple', 'not that apple', 'some apple', 'these apples' etc., all of which employ parts of the apparatus of individuation. To achieve this mastery the child must come to recognise that the term 'apple' refers to distinct individual objects. But the point Quine continually insists upon is that *the apparatus of individuation of another language is always empirically underdetermined*. Because the linguist lacks access to this apparatus of the target language Quine claims the linguist will be unable to determine which expressions to count as predicates and which as subjects, or even if the language contains such elements. Consequently, the linguist will never be able to conclusively determine whether the target conceptual scheme which finds expression in the target language includes three dimensional objects. This leads Quine to say:

I have urged that we could know the necessary and sufficient stimulatory conditions of every possible act of utterance, in a foreign language, and still not know how to determine what objects the speaker of that language believes in.<sup>8</sup>

Such then is Quine's argument for the indeterminacy of translation. But for all the emphasis so far placed on the possibility of significant differences between conceptual schemes (which no one would deny), we must remember that there are common features of our experience which allow for the possibility of translation in the first place. And inasmuch as conceptual schemes are developed in order to make our experiences intelligible, these common features must become elements of our conceptual scheme; and insofar as these experiences are common, they must figure in all conceptual schemes in one form or another. Quine includes among the common features which allow radical translation to get off the ground simple sensory properties (the

material of occasion sentences). He also includes the logical constants of classical logic, and signs of assent and dissent. But three dimensional objects are not included in the set of common features. Once the translator moves beyond this set of common features, indeterminacy sets in, increasing with the distance travelled from this solid foundation.

Those who wish to maintain a realist position with respect to middle size three dimensional objects can agree that signs of assent and dissent are determinately interpretable. We can also retain Quine's position on most of the logical constants of classical logic without further discussion. What we cannot accept, of course, is the implication that three dimensional objects are not common to all conceptual schemes, and hence not candidates for realist interpretation. This raises the prospect that realists must content themselves with what has been called a 'feature placing world'. For if Quine is right we must accept the possibility that the world is not made up of enduring objects at all, despite the fact that our sensory apparatus leads us to believe otherwise. Rather than containing objects, the world may consist of disembodied features or qualities which present themselves to our senses but which are not wedded to any supporting object that possesses these features or qualities. To conclude that these features are supported by objects is to fall prey to our parochial objectifying tendency.

In the rest of this study I will present a series of arguments against Quine's indeterminacy thesis and the phenomenalism it can be used to support. It is my contention that taken together these arguments constitute a formidable assault on the plausibility of the crucial theses that our objectifying pattern is not an invariable trait of human nature and that objects do not cross translation. I will first consider Strawson's highly suggestive argument that identification and re identification of objects in language is made possible by the fact that language users share a common conceptual framework of space and time. If Strawson is correct, possession of the conceptual framework of space and time is made possible precisely by the recognition of the presence of three dimensional objects. I will then call upon Evan's



argument to the effect that, pace Quine, mastery of the foreign apparatus of individuation is not a necessary condition of a linguist identifying expressions playing the role of subjects and predicates in the sentences of the target language. Evan's argument suggests that if the target language speaker objectifies as we do, and we have good reason to believe that he does, then we will be able to obtain behavioural evidence to this effect. Finally, I will consider Davidson's Rule of Three, which suggests that Quine overlooks an important source of information upon which the linguist can call when in the initial stages of translation. This argument has the effect of mitigating the importance of the fact that reference is behaviourally inscrutable and lends credibility to the suggestion that all humans not merely objectify, but objectify in much the same way.

### *Strawson and the Space-Time conceptual framework*

In his work *Individuals*, Strawson outlines and develops a descriptive metaphysics.<sup>9</sup> From Part One in particular an argument can be extracted which serves to highlight the difficulties facing anyone who wishes to defend the coherence of a feature placing world. Strawson draws attention to the fact that certain linguistic practices, in particular, our ability to identify and re identify objects in language, is difficult to account for in a feature placing world since these abilities are seen to imply the existence of material bodies and persons.

Strawson begins Part One by listing the leading assumptions of our conceptual scheme. These assumptions are as follows:

- i) The world contains contingent particular things, 'some of which are independent of ourselves'. This statement expresses both the metaphysical realist view of the mind-independent nature of the world, and the additional view that this world consists of independently existing things.
- ii) The world has a history of particular episodes. Apart from things, there are also happenings, or events, in this world.

iii) We can talk about these things and happenings in our discussions with fellow language users. This is to say that in language we are able to refer to things and that our references are clear to our interlocutors. In Strawson's terminology, we can *identify particulars*.

iv) This set of three principles is completed by the fourth and final guiding assumption, namely that all language users experience the world in a single, unified spatio-temporal framework. Strawson does not state explicitly that *all human beings* experience the world in this way regardless of cultural background, but his argument can be universalised in this way, as I will show.

Having acknowledged his assent to this set of assumptions, Strawson eventually draws our attention to a particular problem, namely, the difficulty of arguing in their defence. Indeed, as any student of rhetoric knows, the premises of any successful argument must be more certain than the conclusion to which they lend support. Premises less certain than the conclusion are of no use to the rhetor since the uncertain cannot be established by further uncertainties. But assumptions (i)-(iv) are seemingly as self-evident as one could expect. Consequently, all argument for them will have a whiff of implausibility, an air of being excessively contrived. He writes in acknowledgement of this problem that

It is difficult to see how such beliefs could be argued for except by showing their consonance with the conceptual scheme which we operate, by showing how they reflect the structure of that scheme.<sup>10</sup>

The conceptual scheme to which Strawson is referring is the spatio-temporal framework of (iv). On the face of it then, Strawson's only plausible strategy is to present a coherentist argument in support of these claims. In the course of this argument Strawson makes the particularly interesting claim that (iii) would not be possible were it not for (iv), i.e., that our ability to identify particulars is made possible by the fact that we all experience the world in a spatio-temporal framework. Just as importantly, Strawson argues that (iv) would not be conceivable without (i) and (ii) being true.

My intention is to modify Strawson's argument to suit the purposes we

have set ourselves. The reader will recall that I am interested in proving that our objectifying tendency that Quine has noticed is an invariable trait of human experience. Strawson provides the resources for such an argument. The modified argument I want to forward is the following:

- 1) All human beings capable of using language inevitably experience the world in a unified spatio-temporal framework.
- 2) In order to operate with the spatio-temporal framework, the language user must recognise the existence of what Strawson has termed 'basic particulars'. These basic particulars are enduring three dimensional objects of which persons are one type.
- 3) Given 1 and 2, all language users recognise the existence of basic particulars. In other words, objectifying is an invariable trait of human beings capable of using language.

I will call upon Strawson's work to lend support to premises 1) and 2) from which the desired conclusion is derived.

The argument for the first premise is as follows. For a language to be useful language users must be able to express thoughts about elements of their experience to other language users. But in order for this to be achieved language users must be able to identify and re identify particular elements of their experience. Now the successful identification and re identification of such elements referred to in another's speech is made possible by two facts: One, a pre-condition of language itself, that the interlocutors are enduring objects themselves. This, I will argue, is a condition of language being developed at all; and two, the interlocutors share a common, unified spatio-temporal framework. The result is that communication through language demands that its users employ a unified spatio-temporal framework. This argument in turn needs to be examined in closer detail. It is here that Strawson's work becomes useful.

Strawson takes as his point of departure two facts about our linguistic practice. First, he assumes that we can successfully identify particulars in our common discourse. Second, he assumes that we are able to re identify these particulars at a later date. Strawson gives as

examples of these two facts the following sentence types: 'I bought *that book* today', and '*That book* is the same book I bought yesterday'. However, Strawson recognises that these two assumptions are not entirely unproblematic given that our field of observation is limited. Since we cannot look in all directions at once, and given that we must occasionally sleep, we must recognise that we are unable to survey everything at once or at all times. Granted our restricted field of observation Strawson realises that re identification is a problem. How do we know that the book before us today is *numerically identical* to the book bought yesterday and not simply a qualitatively similar facsimile? Underlying this doubt is the matter of whether there are three dimensional objects that endure through time, or whether all that exists are features qualitatively similar but not numerically identical because not united to a single supporting object.

Sceptics will argue that we are ultimately unable to justify our claims to re identify particulars. We have no justification for the claim that we are re identifying particular objects rather than identifying for the first time qualitatively similar features which are not united by an underlying self-same object. This doubt serves to strengthen the case for a feature placing world. Strawson is unable to accept this. He states that our ability to use the unified spatio-temporal framework is dependent upon our '*unquestioning acceptance* of particular-re identification in at least some cases of non-continuous observation' (my emphasis).<sup>11</sup> He then states that to not accept particular re identification forces one to make extensive revisions to a belief system that seems very well equipped to describe our experience. Strawson's argument relies on the hope that the reader will not be attracted to such a prospect and will remain content with the highly successful conceptual framework already in place. However, I feel that Strawson could have forwarded a stronger argument. He could have said that a condition of *language itself* is the *fact* of particular re identification and not mere qualitative/feature identity in at least some cases of non-continuous observation. It is not that to employ a unified spatio-temporal framework one must 'go along', as it were, with the belief in particular re identification; the fact that one is able to use language is enough to establish particular re identification in some cases.

How is this so? If we were to abandon our commitment to enduring objects that can be re identified, we are faced with a feature placing world. This means that we are forced to posit new features (many of which are of apparent objects and people) each and every time we shift our field of observation and each and every time we open our eyes to greet the morning. Apart from being highly revisionary and not in accordance with our intuitions, such a situation would not permit the development of language. In order for a language to develop a *stable* community of potential language users must be in place. If there were no self-same group of people living together over a period of time, language as an activity would not be possible. Certainly no language as complex as ours or of any usefulness could be developed. This is because language is essentially a communal, rule governed activity. A condition of language's possibility is that *over a period of time* these rules are agreed to and adopted as customary practice. But if we must posit a completely new set of 'feature-objects' and 'feature-people' every time our field of observation changes, the necessary fixing of practices could not occur. Indeed, one can also see that the teaching and learning of language would be impossible as well, and our linguist working at translating the feature-person's language would be working in vain. No language is ever mastered in the space of time available in a single span of conscious attention. Now since it is patently obvious that there are competent speakers of highly complex languages, it would seem impossible to maintain that we are unable to re identify particulars. We must at the very least be able to re identify other language users. *Language demands that speakers have access to the same people over and over again to ensure that the speakers have time to develop a common vocabulary and fix a set of grammatical rules governing how meaningful sentences are to be constructed.* In other words, particular re identification at least in the case of people is a necessary condition for successful language use.

Once the necessity of re identification of people has been established we can then call upon Strawson's argument concerning the conditions underlying the possibility of successful re identification of particulars *in language*. To the question: How is it possible that a speaker can identify and re identify a particular element of his experience in speech

and have his reference understood by an interlocutor? Strawson replies: This activity is made possible by the fact that both interlocutors are operating with the same unified spatio-temporal framework:

We can make it clear to each other what or which particular things our discourse is about because we can fit together each other's reports and stories into a single picture of the world; and the framework of that picture is a unitary spatio-temporal framework, of one temporal and three spatial dimensions. Hence, as things are, particular-identification in general rests ultimately on the possibility of locating the particular things we speak of in a single unified spatio-temporal system.<sup>12</sup>

The basic elements of the speaker's experience about which he is talking are all found in some region of space and time and are related to all other elements in space and time, including both speaker and hearer. Because the hearer himself is found within the same spatio-temporal framework as the speaker, they are related to each other and to all other elements in space and time. The elements referred to by the speaker can then be identified by the hearer once he is advised of the 'co-ordinates' of the element under discussion.

Strawson is not content, however, with showing that the spatio-temporal framework allows for particular identification and re-identification. He wants to argue the stronger claim that this framework is *necessary* for any particular identification. Strawson hopes to establish this claim by means of a thought experiment. At issue is whether one could identify particulars when operating with a conceptual framework bereft of the concepts of space or time, or both. To investigate this problem Strawson undertakes a study of a No-Space world, a world in which the language users lack any concept of space. The question he considers is whether such a framework could allow the user to identify particulars.<sup>13</sup>

In order to get such a framework, however, Strawson argues that the user could not have the full range of senses enjoyed by humans. In fact, he goes so far as to suggest that in order to achieve a No-Space world the user of such a conceptual scheme would have to be restricted

to a world exclusively auditory in character. The rationale for this claim is that the other senses carry with them an inevitable awareness of space. This claim is harder to justify with the senses of taste and smell, but it is clear enough for the remaining senses. Things seen are seen to be at a distance from the seer, and things touched are felt to be in a different location than the toucher, i.e., not in the same space as the toucher himself but outside the boundary of the toucher's body.

The questions that now need to be considered are the following. First, in such a No-Space world could the user distinguish between himself and the other particulars of which he is aware? In Strawson's terminology: "Can the conditions of a non-solipsistic consciousness be fulfilled for a purely auditory experience?"<sup>14</sup> Second, could the user of this conceptual framework re identify particulars? Could the user distinguish between qualitative and numerical identity?

Strawson answers both of these questions in the negative. As to the first problem, it is not clear that solipsism could be avoided. Given that the user has no conception of space it is unclear where discrete entities could be if not within the private experience of a single individual user. As to the second, it seems improbable that the user could re identify particulars given the nature of the experiences he is capable of having. In order for re identification to be possible, the conceptual scheme has to make intelligible the possibility of an "unperceived, but existing particular".<sup>15</sup> Moreover, it must make intelligible the possibility of particulars that are perceivable on some occasions but not on others. Sounds, the only particulars that are available in a No-Space world, do not appear to have the necessary characteristics that re identifiable particulars require, i.e., the characteristics that allow for numerical identity to be established as opposed to qualitative identity. On the other hand, three dimensional enduring objects that have an *independent* existence in space are the sorts of things that can be re identified at a later date precisely because they can continue to exist while passing in and out of our field of experience.

What conclusions can be drawn from this thought experiment? I would submit that we can conclude that the conceptual framework of space

and time is necessary, at the very least, in the case of the kinds of identifications and re identifications that are customary in normal human experience. I would also submit that in a No-Space world it is not readily apparent that one would have a clear idea of other people besides the self with whom it shares identical surroundings. Indeed 'surroundings' has to be taken analogically since surroundings imply a space in which one finds oneself. But if these conditions are not met, namely, a community of enduring language users (of at least two) and a shared surrounding about which to converse and in which the people are located, it seems quite unlikely that if speech were heard the user could identify it as the speech of another, let alone what the other might be talking about.

The conclusion to which we are then led is premise one: All humans capable of using language must employ a single, unified spatio-temporal framework. We must assume that language users are able to re identify other language users in order for language to be a possibility, i.e., that at least one kind of enduring object exists. But the ability to identify particulars referred to in another' speech, the other *sine qua non* of useful language, depends on the interlocutors sharing a common spatio-temporal framework.

We are now in a position to consider the second of the premises in my argument, namely, that in order to operate with a unified spatio-temporal framework one must have recognised the existence of enduring three dimensional objects, or what Strawson has called 'basic particulars'. This is Strawson's most interesting thesis about the relationship between assumptions (i)-(iv), but also the most difficult to establish. One might consider the possibility that what we are faced with is a relationship of virtuous circularity, rather than strict priority. In other words, it might be the case that one cannot operate with a unified spatio-temporal framework without recognising enduring objects, but that there can be no conception of enduring objects without the concepts of a connected space-time framework. However, given the nature of this particular thesis one cannot expect a demonstrative argument. What can be hoped for is a dialectical argument, one that suggests rather than conclusively establishes the thesis in question.



Strawson begins his argument with the claim that without objects there would be no identification of places.<sup>16</sup> Places, says Strawson, are identified and defined 'only by the relations of things'.<sup>17</sup> Such a statement can be interpreted as containing two distinct theses which we would do well to separate. The first is a thesis concerning the *nature* of space and time. The second concerns the *origins of our awareness* of connected places and times. With respect to the first thesis, Kantians, Substantialists and Relativists find much to discuss, but this matter does not concern us here. What concerns us is not *what* space and time are, but rather *how* we come by our particular conceptions of them. This is an entirely different matter about which Kantians, Substantialists and Relativists could in theory agree. On this point Strawson has given his story: we come by our spatio-temporal framework through our experience of enduring three dimensional objects. It is only by experiencing objects themselves extended in four dimensions, and related to other similar objects, that we come to conceive of connected places and times. Indeed, Strawson goes so far as to say that it is the objects themselves that *constitute* the framework; the framework is not *extraneous* to the objects of which we speak.<sup>18</sup> It is only objects that could give the framework its essential characteristics, i.e., extension in four dimensions. Again, this stronger thesis need not concern us.

The question to be considered is whether experience of such objects is indeed a precondition of possessing a single, unified spatio-temporal framework. It seems that the only way to argue for this thesis is to point out how improbable it is that one could have a unified spatio-temporal framework without experience of three dimensional enduring objects. But is experience of features not enough to give rise to the concepts of space and time? It seems reasonable to assume that experience of features is enough to allow for the recognition of places (a place being that contained within the boundaries of a feature) and of time (features change, or are replaced, which allows for the recognition of a succession of events). But while experience of features is enough to give rise to the concepts of space and time, they are arguably not sufficient to give rise to our single, unified spatio-temporal framework. In a feature-placing world one could only arrive at the conception of

*many, unconnected* places and times because each new stretch of consciousness gives rise to a *new* space-time. It is a new space-time because there is nothing in a currently featuring space-time to connect it to non-current spaces and times experienced, or to be experienced, in other stretches of consciousness. Given the nature of features, nothing in one space-time can exist in, or be carried over into, another space-time. The only way one could make sense of carrying something over from one space-time to another (thereby establishing a connection between them) is to say that one has *re identified* an *x* that is capable of existing despite not being under continuous observation. But such an *x* could not be an ephemeral feature. Now in our unified spatio-temporal framework no conceptual difficulty arises concerning re identification. Enduring three dimensional objects are just the sort of thing that can be carried from one space-time to another. We are able to posit objects and events in regions of space that are somewhere and at some time even though they are not presently featuring to us. This makes no sense in a feature-placing world. In such a world the non-featuring are nowhere and no when, and in no relation to the presently featuring (indeed they simply do not exist). This discrepancy is manifested in the inability of a person operating within a feature-placing world to make sense of questions like, "Where and when is this raining in relation to some other raining?" There simply is no connection between one raining and another unless both are featuring simultaneously. Consequently, we can say that the concepts of space and time are available to those operating in a feature-placing world; but given that re identification is impossible in such a framework, spaces and times will not be unified into one unified spatio-temporal framework. In a feature-placing world there will be only local, unconnected spaces and times.

Such then are the arguments for the two premise of my core argument. If language use depends on speakers having a single, unified spatio-temporal framework; and if possession of such a framework depends on speakers having experience of three dimensional enduring objects, then it stands to reason that all language users have experience of three dimensional enduring objects. In other words, we are in a position to claim that if a person manifests his linguistic ability by competently speaking an language, we can assume that he objectifies. This being

the case, our hypothetical linguist cannot translate 'Gavagai' as 'It rabbiteth', or by any other locution which does not commit the speaker to the existence of enduring objects.

But another question remains. Has anything said so far indicate that 'Gavagai' could not be translated as 'Rabbit parts' instead of 'Lo, a rabbit'? There is no explicit argument to be had from Strawson on this matter - it simply was not something he needed to deal with in *Individuals*. Indeed, he merely stipulates that basic particulars must be material bodies which are non-private and observable.<sup>19</sup> It would appear that parts of bodies fit this set of criteria. Nevertheless an argument from the nature of identification and re identification can be forwarded in support of the thesis that 'Gavagai' ought not to be translated as 'Rabbit parts'. Though relying on a reworking of Wiggins' assumptions concerning the nature of individuation, this argument nevertheless turns on a Strawsonian distinction between those particulars that are 'basic' to our conceptual scheme and those which are not. Given the nature of this argument we would do well to include it this section on Strawson despite the fact that he has been used primarily to counter the claims made in favour of a feature-placing world.

In Part I, Chapter Three of *Individuals* Strawson introduces a distinction between classes of particulars that are 'basic' and classes of particulars that are not 'basic'. A 'basic' particular is defined as a particular to which one *can* refer without making identifying references to other particulars; conversely, a non-basic particular is one to which one *cannot* refer without making identifying reference to other particulars. Strawson argues that material bodies are 'basic' in this sense, while reference to particulars like events, processes, states and conditions (as well as theoretical entities) requires identifying references to material bodies. This accords well with our intuitions, in that events or processes are events or processes *of material things*, as are states and conditions. It is not clear how one could identify a process, say, without identifying the material body undergoing that process. Now the point to draw from this distinction is the following: if one can show that an

identifying reference to a particular  $x$  cannot be made without an identifying reference being made to another particular  $y$ , then recognition on the part of the speaker of particular  $x$  proves that he also recognises  $y$ . We can also push a stronger claim; we can say that it is a necessary condition of the identification of a non-basic particular that the interlocutors can identify the requisite basic particular. To stick with our example, if one cannot identify a material body  $y$ , one will not be able to identify any process  $x$  which body  $y$  may undergo.

With this relationship between basic and non-basic particulars in place we can now move on to consider the relationship that obtains between wholes (in our case, rabbits) and their parts. I will argue that wholes are basic with respect to their parts, and not just to the events, processes, states and conditions they undergo.

My argument rests on three claims about the nature of individuation which Wiggins has defended at great length in his *Sameness and Substance*.<sup>20</sup> First, one cannot make an identifying reference to  $x$  without 'singling out' the intended object from all other objects in the spatio-temporal framework of the interlocutors. I take this to be uncontroversial since this is precisely what one does when making an identifying reference. Second, Wiggins argues that one cannot single out  $x$  without singling it out as something.<sup>2</sup> Now it might be argued that  $x$ 's spatio-temporal co-ordinates alone are enough to single  $x$  out from all other things.  $x$  would be 'that object at the specified spatio-temporal co-ordinates'. However this may be,  $x$ 's spatio-temporal co-ordinates will not be enough *re identify*  $x$ . To *track*  $x$  in the spatio-temporal framework .i.e., to *re identify*  $x$  at different spatio-temporal co-ordinates, one must know *what*  $x$  is in order to distinguish it from all other similar and dissimilar things which take their place in the unified spatio-temporal framework. Spatio-temporal co-ordinates are not enough to *re identify* an  $x$  because  $x$ 's spatio-temporal co-ordinates change as  $x$  moves through space and time. Consequently, to be able to say that  $x$  is the same  $x$  as encountered on a previous occasion one must be able to answer the question, the same *what*? For if  $x$  is identical to  $y$ , they are identical in virtue of *what*  $x$  and  $y$  are. To use a construction of Wiggins, to say that  $x=y$  one must be able to say that  $x$

is the same  $s$  as  $y$ , where  $s$  is a sortal concept whose extension includes  $x$  and  $y$ .

The third assumption about the nature of identifying references is the following:  $x$  can be taken to fall under a sortal concept  $g$  if it performs the operations, functions, or constitutive activities associated with that sort of thing  $g$ .<sup>22</sup> So  $x$  must have all the observable properties of a  $g$ , in addition to acting like a  $g$ , or fulfilling the role of a  $g$ . If an  $x$  fails to meet these requirements,  $x$  cannot be identified as a  $g$ .

With these assumptions in place we can now move on to consider the relationship that obtains between wholes and their parts. The key point is the following: the constitutive activity, function, or operation of what we would call parts of a whole are not intelligible without reference to the whole of which the part is a part. The activities or operations of hands, paws, legs, heads, livers, etc., are not separable either intellectually or physically from the whole of which they are a part. This remains the case even if parts are interchangeable between various wholes. The function of a leg, for example, cannot be described without reference to a body which employs it for transportation purposes; and the same can be said of all body parts. This has led some to say that a finger, for example, which has been severed from a hand *is no longer a finger* except in an equivocal sense. The rationale for this claim is that an organ or limb not joined to a body no longer performs its proper operations.<sup>23</sup>

Now, if to re identify a particular  $x$  we must identify it as an  $s$ ; and if to identify an  $x$  as an  $s$  we must recognise  $x$  as performing the operations of an  $s$ ; then, if the operations of an  $s$  cannot be made intelligible without reference to something else, then this something else must be basic to the re identification of  $x$ . It is my belief that parts are just this sort of particular. *Whole* material bodies are basic with respect to their parts because the latter are intelligible (and thus identifiable as such and so) only when related to the whole of which they are a part. And this is because to recognise the function of a leg or hand one must see it as a part of a whole. Now if this is the case, it is not possible to re identify body parts without re identifying whole bodies. And if this is

the case, then the question cannot arise concerning the possibility of one possessing a unified spatio-temporal framework while re-identifying only body parts. Consequently, even if there were target language speakers who, for some reason or another, deemed it convenient to work with an ontology of body parts rather than whole material bodies, they would still have to go *via* wholes to get to the parts they wish to focus on. This being the case, we can say that our hypothetical linguist ought to translate 'Gavagai' as 'Lo, a rabbit' rather than 'Rabbit parts', unless some further considerations lead him to think the target language speaker is in fact restricting his attention on a particular occasion to a body part rather than the rabbit as a whole. But there can be no question that any ontology including body parts will of necessity also include the wholes of which these parts are parts. With this we can close our examination of the question concerning whether all language users objectify in much the same way we do.

### *Evans and the Apparatus of Individuation*

If Strawson gives us reason to believe that all language users objectify, then Evans provides an argument to suggest that a linguist can obtain behavioural evidence to this effect. Evans begins his argument against the indeterminacy of translation by noting the importance Quine has placed on the linguist's alleged need for determinate access to the apparatus of individuation of the target language in order to identify the grammatical role played by particular linguistic expressions in target sentences.<sup>24</sup> Quine claims that the linguist is unable to determine if a term plays the grammatical role of a noun or predicate unless he has a mastery of the target language's apparatus of individuation. He also states that the linguist cannot identify a term as a predicate unless the term 'interacts' with this illusive apparatus. So in cases where a linguist is presented with simple one word sentences like 'Gavagai' (which contains no elements of this apparatus) translation is indeterminate because 'rabbit', 'rabbit parts', 'rabbiteth', and 'rabbithood' are all stimulus equivalent. But the linguist fares no better when he is presented with complex sentences of the form, 'A G is F' or 'Some G is F' or 'This G is F', where elements of the apparatus are

present. The linguist will still be unable to determine the grammatical function of the terms 'G' and 'F' because the apparatus of individuation remains empirically indeterminate.

Evans' argument against the indeterminacy of translation thesis amounts to a denial of the claim that an expression can only be taken to count as a predicate if it 'interacts' with the apparatus of individuation, i.e. if it enters into sentences of the sort 'Some G is F'. Evans argues that, if Quine were right, the only reason a linguist would have for introducing predicates into his translation manual of the target language would be to explain an expression's interaction with the apparatus of individuation. Evans' strategy is to demonstrate that there are other reasons for introducing predicates into one's translation manual (and along with predicates, nouns who take those predicates). If Evans can provide this additional motivation we may come to see that certain expressions must be interpreted as containing reference to objects and their properties and not merely to features in the sensory field despite the linguist's lack of familiarity with the target language's apparatus of individuation.

Evans' thesis is that in some cases a linguist will be forced to translate 'Gavagai' by 'rabbit' and not by one of the other candidates. He supports this view by showing that to give the semantics of certain expressions not containing any elements of the apparatus of individuation the linguist must treat them as containing terms playing the role of predicates and objects. In other words, Evans wants to show that an expression *can* be identified as a predicate *without* that expression interacting with the apparatus of individuation. If this can be done Quine's argument for the indeterminacy of translation is refuted, at least insofar as occasion sentences are concerned, because the necessity of having determinate access to the foreign apparatus of individuation in order to identify predicates in the target sentences has been overcome.

Evans' argument rests on the claim that the real reason for a linguist to introduce predicates and objects into one's translation manual of the target language is to explain the truth conditions of *compound*

sentences. Evans agrees that simple one word sentences with no structure, sentences like 'Gavagai', are indeed indeterminate, and for the reasons Quine has given. Yet in order for a language to function as an adequate instrument of communication it must incorporate compound expressions and negation, i.e., speakers must be able to say something about aspects of their experience, as well as deny something about aspects of their experience. In other words, any language that will allow for communication must be capable of predication. Evan's crucial point, however, is that when faced with a language containing only compound expressions and negation (and lacking any apparatus of individuation), the linguist must posit objects in order to give the semantics of both a particular linguist disposition and of some of these compound expressions.

Evans argues that the linguist must introduce objects into his translation manual for two reasons. First, the foreign language user will be taken to recognise the existence of objects in order to explain his disposition "to withhold contrary predicates of the things identified."<sup>25</sup> As Evans writes, an object is a thing limited by a fixed boundary that traces the limit of the object's extension in space. That such boundaries are recognised by the target language user is detectable in the speaker's refusal to admit simultaneous predication of contradictory predicates within the area traced by the boundary. Three dimensional objects are precisely those things that are incapable of taking contradictory predicates at the same time. However the recognition of fixed boundaries cannot be accounted for in a feature placing world. Disembodied features and qualities would be subject to fluidity, merging and melding one with the other precisely because they lack fixed boundaries. In order to get relative stability in one's field of experience, one must posit bodies that have fixed boundaries. That the target language user displays this tendency to withhold contrary predicates within boundaries is then good grounds for believing that he does so because he is speaking of objects.

The second reason for introducing objects into the translation manual is to explain the differences in truth conditions between various compound expressions. Simply put, the stimulus meanings, truth



conditions, and the conditions of assent and dissent of the expression 'white rabbit' are not identical to those of 'white rabbit parts' or 'white rabbiteth' etc. In order to account for these differences the linguist must assume that some of these expressions contain reference to objects, some to parts of objects, and so on. The point Evans is emphasising is simple enough: compound sentences have truth conditions sensitive to the *identity* conditions of the expression's *subject* term. This sensitivity of predication to the identity conditions of the subject term allows the linguist to discriminate between expressions like 'white rabbit' and 'white rabbit parts'. Consequently, if the language being translated is complex enough to contain such compound expressions and negation, then the degree of indeterminacy in the translation will not be as high as Quine suggests it will be. In particular, it will be clear that if the language contains references to objects and their properties the linguist will be able to obtain behavioural evidence to this effect despite the fact that an apparatus of individuation may be lacking altogether.

The conclusion of Evans' argument is that while a language containing only simple one word sentences remains indeterminately translatable, any language complex enough to accommodate predication will be translatable with a greater degree of determinacy that Quine would have us believe. But most importantly for our purposes, we can conclude that *if* a foreign language speaker *does* objectify (and we have argued that he must); and if his sentences do contain references to objects and their properties, then we can obtain behavioural evidence to this effect by concentrating on the truth conditions of compound expressions.

### *Davidson and The Rule of Three*

I turn now to one last argument which lends additional support to the preceding two. In this argument no attention is paid to the technicalities surrounding access to the apparatus of individuation in the remote language. Instead attention is brought to bear on the matter of what evidence the translation manual is based upon. Quine's definition of radical translation makes it very clear what sort of evidence

he thinks the linguist has to work with. Radical translation involves:

translation from a remote language on behavioural evidence,  
unaided by prior dictionaries.<sup>26</sup>

Quine's point has been all along that the linguistic and bodily behaviour of the target language speaker is not enough to allow the linguist to fix translation determinately. Now we have already seen that Evans has given us good reason to think that translation will not be indeterminate at least with respect to objects. But the argument with which we are now concerned provides yet another reason to question Quine's conclusions by identifying other factors the linguist ought to consider besides the linguistic and bodily behaviour of the speaker. Davidson has argued that radical translation is possible only because the linguist and target language speaker have some common experiences and concepts from which to work. Now most of these common experiences derive from their common exposure to external stimuli; but insofar as both linguist and target language user are human beings, they also bring something in common to the external stimuli. This additional consideration allows the linguist to further reduce the indeterminacy of his translation by allowing him to exploit what has been called The Rule of Three .

The Rule of Three is a calculus of sorts which allows one to make inferences about one unknown variable given information about the other two variables in the equation. The variables in this equation are the beliefs, desires and capacities of a complex agent. The rule is simply a statement concerning the relationships that have been noticed to obtain between these variables. The rule of three states that when something is known of any two of this set of three elements of an organism it is possible to infer something about the third when presented with a particular action performed by the organism.

An example will help to clarify this principle. Imagine the following scenario: a psychologist is studying the behaviour of gorillas and to this end has contrived a way of isolating the various elements required to explain a particular gorilla's behaviour. The psychologist has placed a

gorillan delicacy in a locked transparent container (a wire cage would do) in the proximity of a gorilla. In addition, the key to the container is placed near by, in close proximity to the gorilla and the container. Let us now imagine a series of possibilities. First, let us imagine that the psychologist knows the gorilla is physically capable of manipulating the key successfully, i.e., that the gorilla has the dexterity to perform the action of unlocking the cage. In addition assume that the gorilla has manifested its desire for the food stuff. The psychologist is now in the position to determine something about what the gorilla knows. If the gorilla's desire for the food is frustrated, then, all things being equal, the psychologist can infer that the gorilla does not know how to employ the key. The psychologist reasons that if the gorilla is able to use the key and wants the delicacy, then all that is preventing the gorilla from attaining his desire is the lack of knowledge concerning the usefulness of keys. On the other hand, if the gorilla uses the key and achieves his aim, one can conclude that the gorilla knows how to use a key.

Imagine now that it is again clear the gorilla desires the food stuff and that it understands that the key can be used to open the cage (he manifests this knowledge by repeatedly attempting to use the key to open the cage). The psychologist is now in a position to infer something about the gorilla's capacities. If the gorilla's desires are frustrated one can infer that this gorilla as yet lacks the dexterity to manipulate the key successfully. On the other hand, if he succeeds then it is perfectly obvious that he has this particular capacity.

Finally, imagine that the psychologist knows the gorilla understands the usefulness of the key and that it is capable of using it to open the cage. Imagine now that the gorilla does not act to attain the delicacy. The psychologist can then safely infer that the gorilla does not at present desire the food. On the other hand, if it does make an effort to attain the food one can safely assume the gorilla is motivated by the appropriate desire. It is worth noting that little can be inferred about an organism's desires, its capacities or its beliefs from its behaviour alone. It is only when something concerning two of the three elements is known that something can be safely inferred about the third.

The relation of this principle to the problem of radical translation is not far to seek. When faced with the brute behaviour of an agent the interpreter of that behaviour is not confined to that behaviour alone. The rule of three can be employed in the interpretation process when something of two of the three elements is known. When a linguist undertakes to translate a remote language he is attempting to interpret the linguistic behaviour of the target language speaker. In so doing the linguist must address himself to the question of what his interlocutor *believes* because it is quite impossible to determine what a speaker means without knowing what he believes, and vice versa. Consequently, as we have seen, in the early stages of translation the linguist must posit a set of beliefs he attributes to the speaker in order to break into the hermeneutic circle. The matter of what this set of beliefs ought to be is then of singular importance and any guidelines in this matter ought not to be ignored. Quine's advice to the linguist is to 'save the obvious': the linguist ought not to interpret the speaker's sentences in such a way as to make them express obviously false beliefs. What the rule of three suggests is that the linguist has an additional factor to consider: the beliefs attributed to the speaker ought not to conflict with his capacities and desires, insofar as they are known. The linguist must take into account the truth conditions of expression; but the translation manual must also be psychologically plausible, i.e., consistent with the desires and capacities of the target language speaker. Now it might be impossible to fix the speaker's desires and capacities without reference to his beliefs; but it is not necessary that this be achieved. The point is not that desires and capacities are more easily fixed than beliefs. The point is that they are an additional factor to be considered by the linguist when he chooses the set of beliefs to attribute to the target language speaker.

Davidson has picked up on the inter relatedness of meaning, belief, desire and capacity and has suggested that if the linguist can form an adequate idea of the speaker's general capabilities, wants and desires, then he will be in a better position to interpret the speaker's utterances more precisely. Of Quine's contention that the possibility exists of obtaining two translation manuals that are empirically adequate yet inconsistent Davidson has this to say:

There are often cases, I believe with Quine, when the totality of relevant evidence in a person's behaviour is equally well handled by each of two theories of truth, provided we make compensating adjustments in our theory of his beliefs and other attitudes, and yet where on one theory a particular sentence is interpreted in one way as to make it true, and on the other not.<sup>27</sup>

This would appear to be in complete agreement with Quine's indeterminacy of translation thesis. However, as Davidson continues he suggests that this indeterminacy can be overcome:

What permits us to choose among various languages for a speaker is the fact that the evidence - attitudes or actions directed to sentences or utterances - bears not only on the interpretation of speech but also on the attribution of beliefs, wants, and intentions (and not doubt other attitudes). The evidence allows us a choice among languages because we can balance any given choice by an appropriate choice of beliefs and attitudes. This suggests one more way we could relativise a theory of truth or reference: *given certain assumptions about the nature of belief and other attitudes, we could show that, once we have decided what a person's attitudes are, the choice of a language is no longer up for grabs.* Given a comprehensive account of beliefs, desires, intention and the like, it is an empirical question what language a person speaks (my emphasis).<sup>28</sup>

Davidson's point is clear. When the linguist consults behavioural evidence alone translation remains indeterminate, as Quine maintains. This is because one cannot infer anything about a person's beliefs and desires from behavioural evidence alone. But once the rule of three is brought to bear on the matter this indeterminacy is reduced. Once some idea is obtained of the speaker's general attitudes the range of beliefs now attributable to him is restricted.

However, Davidson has also isolated a problem this method faces. If the linguist is able to square all the speaker's behaviour with a set of attributed beliefs it could still be contested that the speaker need not hold those beliefs if we attribute to him a perverse set of goals. We

then are faced with a familiar problem: instead of worrying about what constitutes an obvious belief, the linguist is faced with the problem of determining what goals and desires can be safely attributed to the speaker.

But do we not have a good idea as to at least some of the goals and capacities of the target language speaker? Given that the speaker is an organism of the same species as ourselves it seems reasonable to assume that his goals, desires and capacities at a basic level must needs be similar to our own. Indeed how could this not be the case? Are we to think that somehow our basic bodily needs for food and shelter are not shared by the speaker? Are we to think the speaker does not share our need for a community in which to live? And given these basic bodily needs and the need for co-operation with others like ourselves to meet those needs, are we to think that somehow this community's need and use of language is radically different from our own? If we answer these question in the negative, then our choice of translation manual ought to reflect this; more specifically, we ought to choose a translation manual which makes the target language speakers *intelligible* to us as human beings. Now if the target language speaker's goals are unavoidably similar to ours at a fundamental level; and if he shares the species specific capacities of sensory perception, rationality, language use, etc., then it is reasonable to assume that his beliefs at a *basic level* are bound to be similar to our own. At the very least the range of attributable beliefs will be restricted. For example, it is hardly credible that the remote language speaker does not operate with an ontology of whole, three dimensional objects given that (a) he is himself such an object who (b) requires such objects to feed and clothe himself, and (c) given that he spends his time in the company of language users who are objects themselves.

I say beliefs 'at a basic level' must be similar, meaning beliefs at a low level of theoretical abstraction. For Davidson is quite right to say that

*beyond a point* there is no deciding, even in principle, between the view that the Other has used words as we do but has more or less weird beliefs, and the view that we have translated him wrong (my emphasis).<sup>29</sup>

The crucial point, however, is that this is true only beyond a certain point. As Davidson says, the linguist might well have cause for concern if he were to translate a target sentence as 'All these rabbits are reincarnated men.' Indeed such a sentence could certainly not be used as an occasion sentence since it is anything but obvious. Such a sentence, if accurately translated, is really a theoretical statement about rabbits and the cycle of birth and death, and is therefore not a likely candidate for Cognitive Command. But the fact that the statement is about rabbits and not rabbit parts or rabbithood is most likely not a matter of serious contention. For however odd the belief that rabbits are reincarnated men may be, it certainly is not as implausible as the belief that men can be reincarnated as particular rabbits parts.

Putnam raises two points against this use of the rule of three to fix ever more determinately the linguist's translation of a remote language. He says in *Meaning and the Moral Sciences* that the linguist's reliance on the common desires and capacities of linguist and speaker is based on two false assumptions. First Putnam claims that the linguist is assuming that the speaker's account of his own interests and behaviour is the correct one to use when fixing translation. Putnam's contention is that the speaker's own account is worth considering but that it is not always the correct one to choose.<sup>30</sup>

This point can be admitted without damage to the particular thesis I wish to uphold. I am interested in maintaining a realist interpretation of three dimensional objects. Consequently I have been at pains to establish that translation is *determinate enough* to allow *whole* middle size objects to cross translation without indeterminacy. There is no need as far as my thesis is concerned for translation to be determinate from occasion sentences through to the most speculative theoretical sentences. Consequently I can grant that the linguist must be careful as to what interests he uses to fix translation; but I maintain that the interests needed to supply the determinacy of translation required for my purposes is not such as to demand extensive guess work as to the private interests of the speaker. The interests the linguist can safely use are those sufficient to our needs. These are the species specific interests the linguist has access to by virtue of being a member of the

same species.

Putnam's second argument is more to the purpose. He claims there is no objective, non-interest relative description of the speaker's interests that can be safely used by the linguist to fix translation. More precisely, Putnam contends that there is no true 'psychological description' of the speaker that will include the account of his interests.<sup>31</sup> When faced with the sorts of situations Putnam brings forward (which defy easy interpretation with reference to set of objective interests alone) one is inclined to grant Putnam his point. Clearly when asked to explain with reference to an objective set of interests precisely why a Professor X is found 'stark naked in the girl's dormitory' (one of Putnam's colourful examples) it is easy to see why the linguist will feel he lacks the resources. But again I return to the same point made above. Putnam is right that the complete set of interests that motivate the speaker is not attainable. But it is incorrect to suggest that there is not a species specific set of interests the speaker will share regardless of his personal, individual psychological makeup that can be used to lessen the indeterminacy of simple occasion sentences. Again, that is all I require.

There is a final point to be made concerning the rule of three and our objectifying tendency. This tendency is, I would suggest, more likely to be a function of our sensory apparatus than a product of a particular grammar. It seems more probable that language users created single and general terms in order to cope with the world as it appeared to them. It is less plausible that they would have created terms and then proceeded to find a match for them in the blooming, buzzing confusion. It seems more than reasonable to assume that language was developed to allow early humans to cope with a pre-existing condition, rather than assuming that language fixed how we approach the world of experience. If this is so, then our objectifying tendency is a product of a particular capacity, one that is shared by all members of our species since it flows from a species specific sensory apparatus.



## Summary

Before ending this study on the indeterminacy of translation a brief summary will not go amiss. The main concern of our study was to determine whether the indeterminacy of translation thesis posed a significant threat to the form of realism suggested by our adopted demarcation mechanism. In particular our attention was focused on the question of whether nouns referring to whole, middle size three dimensional objects cross translation determinately. The results of our study suggest that they do.

We saw that we have every reason to believe that our objectifying pattern is not parochial but species wide. Any useful language demands that interlocutors share a unified spatio-temporal framework. But possession of such a framework requires familiarity with whole, enduring three dimensional objects.

We then saw that evidence of the objectifying habits of the speaker's of remote languages is detectable in the linguistic and bodily behaviour of these speakers despite the linguist's inability to determinately translate the language's apparatus of individuation. Consequently it appears that if and when a target language speaker does refer to objects the linguist will be able to gather evidence to this effect.

Finally, we saw that the degree of indeterminacy diminishes even further as the linguist becomes aware of the speaker's desires and capacities. Given that the linguist and speaker share certain unavoidable desires, goals and capacities the range of likely beliefs attributable to the speaker is significantly lessened. Now when one considers the force of these arguments simultaneously it becomes impossible not to conclude that human beings invariably objectify, and objectify in much the same way. In the end there is little or no reason to assume that nouns referring to whole, middle size three dimensional objects do not cross translation determinately.

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<sup>1</sup> Donald Davidson, *Inquiries into Truth and Interpretation*. Oxford: Clarendon Press, 1984.

<sup>2</sup> Evans & McDowell, *Truth and Meaning*. p. xviii.

- <sup>3</sup> Quine, *Philosophy of Logic*. 2nd ed. London: Harvard University Press, 1886, p.82.
- <sup>4</sup> Quine, *Word and Object*. Cambridge Mass: MIT Press, 1960, p. 56-7.
- <sup>5</sup> Quine, 'Speaking of Objects' in *Ontological Relativity and Other Essays*. New York: Columbia University Press. 1969.
- <sup>6</sup> *Ibid.*, p.1.
- <sup>7</sup> *Ibid.*, p.1.
- <sup>8</sup> *Ibid.*,p.11.
- <sup>9</sup> P. F. Strawson, *Individuals: An Essay in Descriptive Metaphysics*. London: Methuen and Co., Ltd., 1959.
- <sup>10</sup> *Ibid.*, p.247.
- <sup>11</sup> *Ibid.*, p. 35.
- <sup>12</sup> *Ibid.*, p. 38.
- <sup>13</sup> We are concerned here only with the identification of extra-linguistic contingent particulars. Numbers and other mathematical entities are not usually taken to exist within the unified spatio- temporal framework.
- <sup>14</sup> *Individuals*, p. 69.
- <sup>15</sup> *Ibid.*, p. 74.
- <sup>16</sup> *Ibid.*, p. 370.
- <sup>17</sup> *Ibid.*, p. 370.
- <sup>18</sup> *Ibid.*, p. 39.
- <sup>19</sup> *Ibid.*, p. 45
- <sup>20</sup> Wiggins, *Sameness and Substance*. Oxford: Basil Blackwell, 1980.
- <sup>21</sup> *Ibid.*, p. 5.
- <sup>22</sup> *Ibid.*, p. 70.
- <sup>23</sup> Aristotle writes in the *Metaphysics*, Book VII, Ch. 10 that a part cannot be well defined without reference to its function (1035b 16-17). Moreover, he says that a hand, ". . . is not a hand in any and every state that is a part of man, but only when it can fulfil its work. . ." (Ch. 11, 1036b 30-32). The function of the part is so crucial to its nature that Aristotle is willing to say that a "dead finger is a finger only in name." (Ch. 10, 1035b 24-25)
- <sup>24</sup> Evans, 'Identity and Predication' in *The Journal of Philosophy*. Vol.72, 1975.
- <sup>25</sup> *Ibid.*, p. 353.
- <sup>26</sup> Quine, *Ontological Relativity and Other Essays*, p. 45.
- <sup>27</sup> *Inquiries into Truth and Interpretation*, p. 239
- <sup>28</sup> *Ibid.*, p. 240.
- <sup>29</sup> *Ibid.*, p. 101.
- <sup>30</sup> Putnam, *Meaning and the Moral Sciences*. London: Routledge and Kegan Paul, 1978, p. 47.
- <sup>31</sup> *Ibid.*, p. 48.

## Part II

### Chapter 1

#### *An Introduction to Aquinas and the philosophy of science*

I stated in the *Preface* that it is with the results of Part I in mind that Aquinas' philosophy of science can be seen to be of more than just historical interest.<sup>1</sup> Why this is so will be unclear as of yet to anyone without some knowledge of Scholasticism and Aquinas in particular. My intention in this chapter is to confront this basic problem head-on by stating in the most general terms how a study of Aquinas' philosophy of science can be useful in our search for a solution to our realist dispute *before* descending into the details of his work. This accomplished, I then want to consider an aspect of our realist dispute which has not received the attention it deserves in modern discussions (although it is hinted at in various places). In so doing I hope to present our problem in a new light, a light which serves to clarify why it is that Aquinas *qua* theologian should have something to contribute to our debate. For I will argue that it is as philosopher *and* as theologian that Aquinas needs to be considered.

#### *Why Study Aquinas?*

The suggestion that at the end of the 20th c. we have something to learn from Scholastic science is likely, at first blush, to provoke ridicule and derision. It ought to be stressed immediately, however, that I have no desire to resurrect old theories. Nevertheless, there is much yet to learn from the Scholastics, especially for philosophers of science. Wallace has drawn our attention to the fact that while the actual theories of the Scholastic natural scientists have little more than historical interest and are certainly no longer relevant to the practitioners of modern science, their philosophico-scientific concerns remain relevant:

It is perhaps noteworthy that most of the problems of natural philosophy, and particularly those formulated by Aristotle, still resist definitive solution in the present day, and in the

main they have passed into the related discipline known as the philosophy of science, where realists and nominalists (now called positivists) continue to be divided over the basic issues.<sup>2</sup>

With this in mind we ought to be open to the possibility that the Scholastics' treatment of these issues, long since lost to main-stream philosophical tradition, may inspire us to see these issues in new ways.

The initial motivation behind returning to the Scholastics for aid in our dispute flows directly from the conclusions drawn in Part One, particularly those concerning the problem of demarcation. Upon reflection it becomes apparent that terms capable of crossing translation determinately, terms capable of taking their place in occasion sentences, are terms for those objects which constitute the 'basic' ontology of Aristotelian metaphysics. Following Harré, we can contrast Aristotelian 'individuals' with those of Parmenides and Heraclitus. Parmenides is known principally as the Presocratic who held that change is an illusion, that what is ultimately real is permanent and unchanging, never coming into being or passing away. These theoretical commitments force one to see apparent change as the mere rearrangement of changeless individuals. This is consistent with the view that ordinary objects are just temporary collections of permanent atoms which will eventually enter into other combinations to form other equally temporary objects. Heraclitus, on the other hand, is thought to have held that there are no enduring objects, that individuals are ephemeral, existing only momentarily. Such a view is consistent with a thorough-going phenomenalism. Aristotelian individuals, however, are created, endure for awhile, undergoing some changes without loss of identity, and ultimately are destroyed. Now, as Harré points out, "Science has assumed that, though the *given* individuals in the world are Aristotelian, *ultimate* individuals are either Parmenidean (atomism) or Heraclitean (phenomenalism)."<sup>3</sup> But what we find in Aristotle is an understanding of the scientific enterprise as a whole, methodology and interpretative rules included, which confines itself, for the most part, to precisely this 'given' set of individuals. Now, since we have conferred a particular status on precisely these objects, it is of some interest to us to see how Aristotle deals with them *without*

*appealing to either Parmenidean or Heraclitean principles.* And given the results of Part I we can say that such an enterprise has the potential to produce scientific statements which are candidates for a realist interpretation.

A further attraction of Aristotelianism is that science, or what he calls natural philosophy, finds its place within an over-arching philosophical framework which includes metaphysics, mathematics and the 'intermediary sciences', as well as Ethics and Politics. In this framework the methodological divide between the "hard" natural sciences and the "soft" social sciences, while not being removed, is rendered more intelligible, as is the distinction between natural science and metaphysics. Although Aristotle insists on drawing hard and fast distinctions between the various disciplines, this is done with the intention of ultimately uniting them within one system. The operating assumption is that human knowledge can be unified and inclusive in the sense that each particular discipline is seen to add something of value to our sum of knowledge, and each can be assigned its appropriate place within a complete philosophical system. But it is important not to forget that Aristotle insists upon the clear recognition of the diversity of subject matter treated by the various disciplines. This recognition is accompanied by the equally important realisation that the diversity of subject matter must be matched by a corresponding diversity of methodology *and interpretative approach*. There is no one scientific method to be applied in all disciplines, as there is no one interpretative approach to be applied to all of science's products. The object of study in each discipline must be carefully identified and treated in a manner fitting its nature and our epistemological capabilities. This methodological and interpretative pluralism allows for the recognition of the unity of our knowledge without effacing important distinctions.

The fact that Aquinas is acknowledged to be one of the great commentators on Aristotle would be enough to justify devoting attention to him. But Aquinas does more than just repeat the teachings of the Peripatetic. As well as clarifying and developing Aristotelian ideas, he employs Aristotle's metaphysics, epistemology and philosophy of science

in his work as a theologian, particularly in his investigations concerning the nature of our knowledge of God and the other immaterial substances. It is this work in particular, rarely studied by modern philosophers, that makes Aquinas of special importance to us. As said above, in Aristotle we find a philosophical system which deals with a basic ontology remarkably similar to that set of entities the terms for which cross translation determinately. What we find in Aquinas is an acceptance of Aristotle's philosophical framework and basic ontology *plus* an additional emphasis on a set of entities which are significantly different from those included in the basic Aristotelian ontology. The point of interest for us is that these entities are of such a nature that knowledge of them cannot be attained through the normal investigative procedures sanctioned by Aristotle and accepted by Aquinas. The addition of this set of entities to the basic ontology, combined with acceptance of Aristotle's epistemology, forces Aquinas to consider carefully what he can say about these entities and how these statements are to be interpreted. Now it is my contention that we have something to learn from Aquinas' careful assessment of our knowledge of God and the other immaterial substances. In particular I suggest that this assessment provides an instructive model for the treatment of science's theoretical entities the terms for which *do not* cross translation determinately. Aquinas, as we have learned from Chénu's classic work<sup>4</sup>, wanted to treat of God in theology as a natural scientist would treat of an entity in his particular domain; in other words, to investigate the nature of God as the natural scientist would investigate any scientific entity within the Aristotelian framework. Theology, with Aquinas, was to become a science of God; for us, philosophy of science is to become, at least in part, theology. Moreover, in Aquinas we find a model of how to proceed in a world characterised explicitly by a demarcation between claims of Reason and claims of Faith. This demarcation is *analogical* to the demarcation I wish to draw between realist and anti-realist domains in the realist dispute in science. Again it has to be emphasised at this point that this is a very general perspective of the importance of Aquinas for our dispute. The details and proper understanding of Aquinas and his import for us is what will occupy us for the remainder of this study.

### *Theology and the Sciences*

But before proceeding with our investigation of Aquinas a few words on the relationship of theology to the sciences will not go amiss. Inevitably some will question the propriety of admitting a theologian to our realist dispute in science. What has theology to do with these matters? it will be asked. But a look at the history of our dispute, and the nature of the sciences themselves reveals that theological issues are not as alien to our concerns as one might suppose, and that theological intuitions have coloured our arguments since its inception. Indeed, there are a number of significant points of contact between the sciences, the realist dispute in science, and theological matters. These points of contact, brought to light by historical studies, are usually passed over or ignored in our debates. Now we cannot enter into a detailed historical study here, in fact we can do little more than wave at various works where these points are discussed; but it is worth while to mention some of these findings if only to establish the plausibility of two points: a) that theology has a greater affinity with science than one might expect, and b) that often the arguments employed in the realist dispute in science have been motivated by, or exploit, pre-philosophical, and certainly pre-scientific, intuitions.

That science and religion in general are linked in popular culture need not be insisted upon. Until quite recently this relationship has usually been taken to be a hostile one. But seeping into popular culture is the idea that there are similarities between recent developments in physics and certain eastern religious traditions. There are also scholarly works which focus on similar connections.<sup>5</sup> However, such links between science and religion, or science and theology, do not concern us here. I am not wanting to argue that, in some sense, science and religion are saying the same thing. This view suggests that science and religion consist of two entirely separate ways of being in the world which happen, quite co-incidentally, to agree on certain matters. The connections between science and theology of concern to us, however, lie at a more fundamental level: some studies in the history of science suggest that there are pre-philosophical intuitions and assumptions, as

well as patterns of thought, at work in theological contexts which are also at work in our local realist dispute. In effect, assumptions which originated in a theological context have been transposed into other areas, in particular into the philosophy of science, where they receive treatment in a manner befitting the new home discipline.

Our suspicion that such a transposition has occurred is aroused initially by comments found in the works of purely secular authors of the 20th c. For example, what are we to make of the tendency of certain authors to use overtly theological terminology or illustrations to describe the respective positions outlined and compared in the realist dispute in science? Consider, for example, Quine's use of the terms "sectarian" and "ecumenical" to describe attitudes or positions taken in response to the possibility of being faced with two empirically equivalent but mutually incompatible theories. Quine writes:

One possible attitude to adopt towards the two theories is a *sectarian* one, as I have called it: treat the rival theory. . . by rejecting all the contexts of its alien terms. We can no longer excuse this unequal treatment of the two theories on the ground that our own is more elegant, but still we can plead that we have no higher access to truth than our evolving theory, however fallible. . . . The opposing attitude is the *ecumenical* one, which would count both theories true. Its appeal is empiricism: reluctance to discriminate invidiously between empirically equivalent and equally economical theories.<sup>6</sup>

Quine also states that in recent years he has "vacillated" between 'sectarianism' and 'ecumenicalism'. Now the fact that Quine uses these terms in no way proves that there is a *bona fide* theological component to our dispute. It is most likely that Quine uses these terms in an analogical sense simply because they are useful heuristically. Nonetheless, it is at least curious that these terms should be so fittingly applied to positions in our debate, and on a matter of critical importance to us, viz., the under determination of theory by data. But there is good reason why these terms are useful. It is important to recognise that the alternatives Quine has noted are characterised by a fundamental difference in *attitude*. The attitudes adopted by both



parties are not, apparently, a matter of discussion, or so it would seem from Quine's presentation of the matter. The attitudes are noted, listed and described; but Quine makes no effort to legislate which attitude ought to be adopted. But, of course, no such discussion is possible for Quine: when presented with two equally elegant, economical and empirically adequate theories, there are no fully rational criteria left to which he can appeal. Both sectarianism and ecumenicalism have something to recommend them (hence the possibility of vacillation); but their respective virtues are not decidable by appeals to pure reason, or to some other standard recognised by both camps. It would seem then that parties on both sides of the dispute are characterised by an apparently *brute attitude* which governs how they proceed in our local debate. Now I want to suggest that these apparently brute attitudes have a history, a history we would do well to bear in mind.

Another author who makes use of theological terminology is Nancy Cartwright. In *How the Laws of Physics Lie*,<sup>7</sup> she candidly admits that the differences between her position in the realist dispute in science and that of the opposition are consistent with two differing views of the nature of God. Consider the following lines:

Pierre Duhem distinguished two kinds of thinkers: the deep but narrow minds of the French, and the broad but shallow minds of the English. The French mind sees things in an elegant, unified way. It takes Newton's three laws of motion and turns them into the beautiful, abstract mathematics of Lagrangian mechanics. The English mind, says Duhem, is an exact contrast. It engineers bits of gears, and pulleys, and keeps the strings from tangling up. It holds a thousand different details all at once, without imposing much abstract order or organisation. *The difference between the realist and me is almost theological. The realist thinks that the creator of the universe worked like a French mathematician. But I think that God has the untidy mind of the English.*[My italics]<sup>8</sup>

Again Cartwright is speaking metaphorically and using such language for its heuristic value alone. However, the points made in Quine's case apply equally well to Cartwright. The theological distinction she draws is remarkably fitting, which is why it is heuristically helpful. But again

there is no attempt to argue for or against the French or English mind sets, or the two corresponding views of God. This is important. While no one would suggest that Cartwright began with a particular view of God and then imposed it consciously on her work in the philosophy of science, it seems not unreasonable to ask if the intuitions and ideas accompanying this view of God (but now dissociated from it) have not coloured her philosophy of science and pre-determined which positions and arguments she will find acceptable. I hasten to add, however, that in this regard Cartwright is probably no different from any other party to our dispute. Her candour alone singles her out for such treatment.

But perhaps the most remarkable references to theology in 20th c. philosophy of science are found in Kuhn's *The Structure of Scientific Revolutions*.<sup>9</sup> We are all now familiar with the notion of paradigm shifts and how these can be likened to the religious experience of 'conversion', at least insofar as there seems to be a degree of 'irrationality' involved in the rejection of one paradigm and the adoption of another. Lakatos has taken Kuhn very seriously on this matter; so seriously in fact, that he feels it necessary to discuss in detail whether scientific change is really not a kind of religious change.<sup>10</sup> Whether science is "reason or religion" is not something we have to determine at this moment; at this juncture it is more important that it be recognised that the similarities between scientific and religious modes of thought brought to light by Kuhn cannot be dismissed as easily as some might like.

However, to my mind, Kuhn's most interesting reference to theology has little to do with the psychology of paradigm shifts. It is during his discussion of the role of authority within the scientific community, in particular the role of authoritative text books in the training of science students, that the more revealing link between science and theology is made. He writes:

Both scientists and laymen take much of their image of creative scientific activity from an authoritative source that systematically disguises - partly for important functional reasons - the existence and significance of scientific revolutions. Only when the nature of that authority is recognised and analysed can one hope to make historical

example fully effective. Furthermore, though the point can be fully developed only in my concluding section, the analysis now required will begin to indicate one of the aspects of scientific work that most clearly distinguishes it from every other creative pursuit *except perhaps theology*.<sup>11</sup> [my italics]

Kuhn makes good his promise in a later chapter where the nature of this 'aspect' is brought out explicitly. While explaining why science is the one enterprise which seems to make 'progress', he leans heavily on the fact that normal science is carried out by a community of scientists all committed to a single paradigm and to the resolution of a particular set of problems. 'Progress' is then defined by reference to this shared project. In this stage of science the "first principles" of the paradigm are assumed to be stable, and attention is focused on the "most esoteric of the phenomena that concern it".<sup>12</sup> Solutions to these esoteric problems are then made known to others from the same scientific community. Kuhn's point is that scientific practice has a tendency to discourage examination of the paradigm's first principles, and that scientific education re-enforces this by not bringing to light, not to say actively obscuring, the fact that other paradigms have been on offer in the development of the particular science in question. There is good reason for such a pedagogical approach. Pointing out the existence of other paradigms tends to draw attention away from the puzzle-solving activity of normal science and to refocus it again on first principles to the detriment of progress. Against this background Kuhn then writes:

Without wishing to defend the excessive lengths to which this type of education has occasionally been carried, one cannot help but notice that in general it has been immensely effective. Of course, it is a narrow and rigid education, probably more so than any other *except perhaps in orthodox theology*.<sup>13</sup> [my italics]

This is curious indeed. Here we have the most highly prized aspect of the scientific enterprise, its undeniable progress, explained, if only partially, in terms of a pedagogical philosophy shared by orthodox theological institutions.

This similar type of education is matched by similarities in the actual

practice of science and theology. These similarities are particularly striking if one has some familiarity with Kuhn's notion of normal science and the rudiments of theological practice. In particular one notices similarities between the thought processes of a scientist engaged in normal science and those, for example, of the Jewish theologians working within the Midrashic tradition.<sup>14</sup> A few words on this theological tradition will suffice to bring out these similarities. According to Emil Fackenheim, Midrashic theology has one basic purpose and four essential elements of actual practice. The *raison d'être* of Midrashic theology is to resist the "dissipation of the root experiences of Judaism" (what one might refer to as Judaism's 'first principles'), and to actively preserve the traditions that have arisen from them in the Jewish community. This essentially *conservative* agenda is not unlike that of the practitioners of normal science who are professionally *committed* to a particular paradigm.

The four elements of the actual day to day practice are also revealing. If one may be permitted to adapt Kuhn's terminology, one might say that "normal theology" begins with:

i) Reflection on the root experiences of the Jewish people (experiences that become the foundations of the Jewish world picture or paradigm).

ii) This reflection leads to an awareness of two types of contradiction. a) contradictions within the set of experiences and interpretation of their meaning, and b) contradictions from without, i.e., ensuing Jewish history may contain events that seem to contradict the traditional understanding of the root experiences.

iii) Nevertheless there is a refusal to abandon those experiences despite the (apparent or real) contradictions, combined with an effort to eliminate them through greater understanding of the tradition.

iv) There is a final acceptance of these contradictions and an ensuing interpretation of the implications of a contradictory framework.

Each one of these elements has its parallel in the practice of normal

science: there is the initial acceptance of a theoretical paradigm upon which the adherent bases his thought; the adherent then discovers, or has pointed out to him, the 'apparent' contradictions between the theory and experience, which are identified as "puzzles"; the adherents then attempt to find explanations for these contradictions, but explanations which are consistent with the first principles of the accepted paradigm; finally, even if the adherents are unable to solve the puzzles, there is no immediate rejection of the paradigm unless a satisfying alternative is ready to hand (and even then many of the established scientists will resist the paradigm shift). The structural similarities at this level between the practice of normal science and theology are quite unmistakable.

If we set aside the philosophy of science for a moment and concentrate rather on the history of science, the importance of the relationship between theology and the realist dispute in science becomes unmistakable. Most historians of science now recognise that science is not a self-contained, autonomous discipline, but that scientific activity both affects and is affected by the rest of the contemporary cultural situation. Moreover, some go so far as to state explicitly that *theological commitments in particular* affect the attitudes scientists have held regarding their work, as well as the content of the theories themselves. Before looking at some specific cases, it is worth asking why this might be the case.

Part of the answer might be that theology and the sciences were, and perhaps still are, different ways of coping with the same human needs, and consequently difficult to distinguish in the early days of the development of science. Consider what Epicurus has to say about the root causes of our interest in the sciences, and how often these same causes are used to explain the origins of religious belief. He writes:

If we had never been molested by alarms at celestial and atmospheric phenomena, nor by the misgivings that death somehow affects us, nor by neglect of the proper limits of pain and desires, we should have had no need to study natural sciences.<sup>15</sup>

and

It would be impossible to banish fear on matters of the highest importance, if a man did not know the nature of the whole universe, but lived in dread of what the legends tell us.<sup>16</sup>

Dales also emphasises the common roots of science and religion his preface to *The Scientific Achievement of the Middle Ages*. He begins his history with the observation that mythology, magic, theology, and science are all born of the same human desires:

Men have tried an interesting variety of ways of dealing with the perceived or "natural" world in which they find themselves. They have imagined it as governed by hostile or benevolent whimsical forces, which they have tried to bribe or propitiate. They have explained it in terms of elaborate mythologies. They have tried to plumb its mysteries by interpreting the flights of birds, innards of beasts, positions of the stars, or delirious mutterings of divinely inspired persons. They have tried to control it through the arts of magic and made it serve man's needs. Or, every now and then, they have sought to understand it according to the categories of human reason.<sup>17</sup>

What is interesting about this passage is the recognition of the two principle desires that motivate scientific activity, viz., understanding and control of nature. But it also suggests that what is peculiar about science is simply the manner in which these practical needs and desires are satisfied. With this in mind it is not entirely surprising that Thorndike's historical studies have revealed that experimental science as we know it is in fact a continuation of the sorts of activities that occupied magicians in their pursuit of knowledge and control of nature.<sup>18</sup>

But it is in Hooykaas that we find an explicit connection between theology and science. He writes: "What people thought about God (or the gods) influenced their conception of nature, and this in turn influenced their method of investigating nature, that is their science."<sup>19</sup> Following the lead of Foster, Hooykaas finds at least a partial explanation for the difference between pre and post revolutionary science in the fact that the theological commitments of the leading scientists had changed.<sup>20</sup> Both argue that the mechanistic world view which characterises the new science is more consistent with Biblical

notions of God than the 'organic' world view of the Scholastics, which had still to fully emancipate itself from pagan theology. It is interesting to note in this regard that Boyle, Hooke and Newton are often referred to as the English 'Christian Virtuosi'. And consider Whitehead's assertion that the very possibility of science is itself a product of theology. In *Science and the Modern World* we read:

The faith in the possibility of science, generated antecedently to the development of modern scientific activity, is an unconscious derivative from medieval theology.<sup>21</sup>

This general point is also supported by William Dampier, who writes in *A History of Science and Its Relations with Philosophy and Religion* that the Scholastic's assumption,

that God and the world are understandable by man implanted in the best minds of Western Europe belief in the regularity and uniformity of nature, without which scientific research would never be attempted.<sup>22</sup>

It is the belief in a rational and benevolent God in particular that provides the assumptions that allow for the possibility of science. The insistence on the uniformity of nature (that in similar circumstances similar effects will be observed) and on the principle of parsimony (simplicity and elegance) is perfectly understandable when one is operating on the assumption that the world is the product of a rational creator, and that the world bears the distinguishing characteristics of its maker. It is also worth remarking that once these principles are removed from their theological context they become merely practical rules of thumb, justified on grounds of convenience, past success, or aesthetic judgements. When this theological framework is set aside we lose the warrant to assume there is any correspondence between our desire for order and simplicity and there actually being order and simplicity in the structure of the world itself.

However, medieval theology not only provides some critical assumptions that make scientific activity possible, it also explains *why* such an activity is valuable in and of itself above and beyond its ability to meet

certain needs. The investigation of nature becomes a worthwhile activity in its own right because nature is God's handiwork.<sup>23</sup> To study nature was to come to know God through his creation.

However, the impact of theological matters on science is not confined to the provision of certain key assumptions that allow for the possibility of science. Edward Grant and Hans Blumenberg have traced the influence of certain theological ideas and events upon the very self-understanding of the contemporary scientific community. Both historians focus in particular on the effects of the condemnation of 1277, which they consider to be of singular importance for the later development of science. This is not the time or place to go into the details of this event or of the other similar condemnations; what I wish to focus on is the impact of this event on the development of the philosophy of science, and the recognition that its causes were extra-scientific. The particular extra-scientific matter in question in this instance was the desire to protect the theological commitment to the omnipotence of the Christian God.

In order to appreciate the impact of the condemnations on the philosophy of science some historical background is required. For most of the early Middle Ages only a few of Aristotle's logical works were available in the Latin west, by far the greater part of his corpus being for all intents and purposes unknown. The same can be said of Plato, the *Timaeus* being the only dialogue known to the Church Fathers and early Scholastics, though they did know some works of Plotinus and other Neo-Platonists. Consequently, for over 700 hundred years intellectuals in the west had access to only fragments of various authors from various philosophical traditions, as well as a number of commentaries and encyclopaedias whose authors tried to preserve the knowledge of classical antiquity, often with little success. Since there was no one systematic and comprehensive philosophical system available, intellectuals were largely free to carry on their theological studies in isolation from the potentially overwhelming influence of the Greeks. When Aristotle's entire corpus was made available, however, theologians and philosophers for the first time had to react to a most impressive philosophical system incorporating theology, metaphysics,



the natural sciences as well as politics and ethics. The grandeur of this philosophical edifice could hardly fail to impress. Gradually, as scholars slowly came to understand and appreciate his work, Aristotle became the authority on all matters philosophical and scientific.

However, as Aristotle's influence grew, a group of extreme Aristotelians, the so-called Latin-Averroists, started to challenge the authority of the Church in the name of the Peripatetic. This conflict was perhaps inevitable since Aristotle did hold certain beliefs about the world that contradicted well-established theological doctrine. The conflicts arose primarily from Aristotle's natural philosophy. Since he claimed that certain actions or events are physically impossible (for instance, that a vacuum could be found in nature), commentators took him to be implying that there are limitations on what the Christian God can do (for instance, it was implied that God cannot move the universe with rectilinear motion since a vacuum would result). As the challenges became more frequent and more insistent (and more insulting), eventually the patience of the Church authorities was broken. A condemnation of 219 theologically problematic propositions thought to be held by Aristotelians was issued, thereby prohibiting the teaching of these propositions on pain of excommunication.

The implications of this condemnation for scientific thought were enormous. One immediate consequence was that natural scientists received encouragement to openly question The Philosopher and reject his teachings if they were found to be in error (either doctrinally or empirically). If Aristotle was wrong on such important doctrinal questions (for example, his insistence on the eternity of the world), then it is easier to think he might be wrong on other matters. This is the feature of the condemnation that most impresses Duhem who sees in this the beginning of the end of Aristotle's overwhelming authority and the start of serious scientific investigations in dynamics which he thought produced ideas that were eventually perfected by Galileo and Newton. Another effect, more important for our purposes, was that Aristotelian natural philosophers were discouraged from attributing a strong realist reading to the theories they developed. They tended to remain content with 'saving the phenomena', not claiming to have found

any literally true theories. Some will say that this position was a cynical ploy adopted in order to avoid conflict with the authorities. It is probably fair to say that this under-estimates the respect for the Church still current among most natural philosophers of the day. Grant's view of the matter is more convincing. He concludes his *Physical Science in the Middle Ages* by stating that the most significant impact of the condemnations was that they led directly to the *extreme* anti-realist tendencies of the late Scholastic scientists. As we shall see, anti-realist tendencies were already present in the thought of the day. But up until the death of Aquinas shortly before the condemnation, the only science to be treated consistently in an anti-realist manner was astronomy. After 1277, anti-realist tendencies spread to all areas of science, engulfing both the super and sub lunar worlds. The Scholastics already had a tendency to doubt the validity of physical explanations; but at the same time they did not expect to find a more reasonable or satisfying physical theory than that provided by Aristotle. Consequently, the condemnation of 1277, in providing theological grounds for rejecting some of Aristotle's key theses, re-enforced a pre-existent tendency to play down what science could achieve. Grant writes:

In the aftermath of the condemnation of 1277, with its emphasis on God's absolute power, their objective was to demonstrate that alternatives to a variety of Aristotelian physical explanations were not only logically possible but in some cases even as plausible as Aristotle's. . . . The condemnations of 1277 and the philosophical and theological consequences that flowed from it in the fourteenth century created an unusual intellectual climate in science and philosophy. No longer was it widely believed that certainty could be acquired about causes and laws of nature. It was now a matter of choosing the most probable of a number of alternatives. . . . A *sophisticated positivistic attitude* developed in which many of the fourteenth century Mertonians and Parisians, who contributed most to fourteenth century thought, abandoned hope of acquiring true knowledge of the physical world.<sup>24</sup>

In Grant's view the most fundamental distinction between late

Scholastic and Modern science is the former's decision to limit itself to saving the appearances and not aspiring to knowledge of the natural world. He also argues that it was only when this attitude was set aside that new developments in science were likely to arise. And it is Copernicus himself who provides this change of attitude. The important feature of Copernicus' work was not his heliocentric system *per se*, *but the manner in which he interpreted his new theory*. Grant writes:

A vast gulf separates the attitude of Copernicus from that of his fourteenth century predecessors. For Copernicus "saving the phenomena" was not a matter of convenience, but truth; for Buridan and Oresme, it was not a matter of truth, but convenience.<sup>25</sup>

Copernicus was a realist, and this, more than anything else, was what caught people's imagination, including the likes of Galileo and Kepler.<sup>26</sup> But as is made clear in the work of Blumenberg, this shift from scientific anti-realism to scientific realism *was itself justified on theological grounds*. It is to this that I now turn.

Grant is correct to identify Copernicus' realism as being the most inspiring aspect of his work. He is less accurate in his suggestion that Copernicus' realism was simply "naive", and "the stuff of error, [and] fantasy. . .".<sup>27</sup> Grant's assertion would be correct if all that were involved in Copernicus' shift to scientific realism was a failure to understand that one cannot infer that one's theory is true on the grounds that it adequately saves the appearances. Grant suggests that this is precisely what Copernicus did: he implies that Copernicus' shift to realism was motivated by the mistaken belief that only *true* hypotheses can save the phenomena.<sup>28</sup> This is indeed naive, especially if it were to be asserted with no further supporting argumentation. To Blumenberg goes the credit, however, of unearthing the arguments and intuitions that would make Copernicus' ostensibly naive view plausible. The point of interest for us, however, is that these arguments and intuitions are ostensibly theological in nature.

In his monumental study of the Copernican revolution<sup>29</sup> Blumenberg

seeks to isolate the factors that brought about the conditions under which Copernicus' heliocentric theory, and realist reading thereof, could be taken seriously by the scientific community. In the course of this work Blumenberg traces the influence of cosmologico-theological ideas on the attitudes of astronomers from the ancient Greeks to Copernicus. What he finds is a direct connection between one's views on the epistemological capabilities of human beings and one's views on, in Blumenberg's terminology, "the quality of the world for man". More precisely, Blumenberg shows that in the past one's realism or anti-realism in astronomy has been a function of one's understanding of the relationship that obtains between human beings and the Cosmos.

Blumenberg identifies three schools of thought on this particular relationship, each with a corresponding epistemology. First, there is what Blumenberg calls 'anthropocentrism', characterised by the view that the world has actually been made for us. On this view the Cosmos would be incomplete if human beings did not exist since humanity is the focus of all creation. Second, there is what Blumenberg calls 'theocentrism', the view that human beings are an integral part of the Cosmos, but that we are not the focus of, or the reason for, creation as a whole. On this view, if the cosmos is for anything, it is for God; and our activities are governed by our duties to the creator and our assigned role in creation. Finally, there is the most pessimistic view that human beings are an '*animal supervacuum*', with no intrinsic relationship to the cosmos, our presence or absence being of no significance to the Cosmos at all. This is usually associated with various forms of Gnosticism, each varying in the degree of malevolence we ought to expect from the creator.

Now if one adopts an anthropocentric theology, and one imbibes the confidence such a view provides, then, argues Blumenberg, there is a tendency to think that our cognitive capabilities are such that we can come to know the entire Cosmos, including the heavens. Naturally, if the Cosmos is there for us, then it makes sense that we should be able to know it and enjoy it in its entirety. What is important for us, however, is that Copernicus relies on precisely this view in the preface to *De Revolutionibus*.<sup>30</sup> Copernicus' main point in his preface is that he

was driven to consider revolutionary possibilities in astronomy because of the unsatisfactory state of his discipline in his day. He writes:

. . . I was impelled to think out another way of calculating the motions of the spheres of the universe by nothing else than the realisation that the mathematicians themselves are inconsistent in investigating them.<sup>31</sup>

Copernicus' contemporaries were in fact using a number of different hypotheses in order to predict the motions of the Sun, Moon and five wandering stars, hypotheses which could not be unified into any realistically interpretable system of astronomy. But it is Copernicus' reaction to this situation that is most revealing. He goes on to say:

Therefore on long pondering this uncertainty of mathematical traditions on the deduction of the motions of the system of the spheres, I began to feel disgust that no more certain theory of the motions of the mechanism of the universe, *which has been established for us (propter nos) by the best and most systematic craftsman of all*, was agreed by the philosophers, who otherwise theorised so minutely with the most careful attention to the details of this system.<sup>32</sup> [my italics]

Blumenberg sees this appeal to the anthropocentric formula as an attempt,

to present astronomy's failure, in spite of painstaking investigations, up to his time, as something by no means God given and unavoidable, but rather as a scandal that is vividly felt as such.<sup>33</sup>

However, if one thinks that we are simply a valuable part of the Cosmos, but that the Cosmos is for some other entity, viz., the creator, then the corresponding assumption with regard to our cognitive capabilities is more moderate: we can know something of the Cosmos, precisely that which we need to know in order to fulfil our role in the order of things; but there is no reason to think (in fact it is impious to think) that the Cosmos in its entirety should be amenable to our limited faculties - there is no need for us to possess such knowledge in order

that the Cosmos should fulfil the desires of the creator. This is the natural position of the Scholastics, which was re-enforced by the condemnation of 1277.

The final alternative is that human beings are in fact entirely superfluous, and that we are here only by mistake or deception (as with the Gnostics). In this circumstance there is no guarantee that we can know anything at all, especially if the Gods are malevolent (consider Descartes' Evil Demon). Given this scenario, survival, rather than knowledge for its own sake, is at a premium. In this framework what one strives for primarily is *control* of nature - knowledge of it being desirable only insofar as it allows us to keep nature at bay, or to totally master it. Blumenberg sees this attitude as being that which characterises modernity most closely<sup>34</sup> (one can certainly hear the echoes of Bacon).

Ultimately what Blumenberg sees in the Copernican revolution is a clash of the theocentric and anthropocentric world pictures, each characterised most fundamentally by their assumed "quality of the world for man" and the accompanying degree of confidence each view entails. We have just to read the texts of the representatives of the various schools to sense the difference in tone and intent between them. If we read Copernicus' opening paragraphs of Book One of *De Revolutionibus* it is impossible to mistake his conviction that despite obvious difficulties astronomical knowledge is ultimately within reach of human efforts. Consider now these lines from Maimonides' *A Guide to the Perplexed*, which capture quite beautifully the essential elements of the theocentric position. Continuing a discussion of how to reconcile Aristotle's physics with Ptolemy's *Almagest*, he writes:

I have already explained to you by word of mouth that all this does not affect the astronomer. For his purpose is not to tell us in which way the spheres truly are, but to posit an astronomical system in which it would be possible for the motions to be circular and uniform and to correspond to what is apprehended through sight, regardless of whether or not things are thus in fact. . .

He explains why this is the proper attitude for the astronomer to adopt in these terms:

All that Aristotle states about that which is beneath the sphere of the moon is in accordance with reasoning; these are things that have a known cause, that follow one upon the other, and concerning which it is clear and manifest at what points wisdom and natural providence are effective. However, regarding all that is in the heavens, man grasps nothing but a small measure of what is mathematical; and you know what is in it. I shall accordingly say in the manner of poetical preciousness (Ps. 115:16): *The heavens are the heavens of the Lord, but the earth hath He given to the sons of men.* I mean thereby that the deity alone fully knows the true reality, the nature, the substance, the form, the motions, and the cause of the heavens. But he has enabled man to have knowledge of what is beneath the heavens, *for that is his world and his dwelling-place in which he has been placed and of which he is a part.* This is the truth . . . . Let us then stop at a point that is within our capacity . . . .<sup>35</sup>

What is most striking about these two world views is the connection between theological theses and the realist dispute in science, between the degree of confidence these theses inspire and the corresponding estimation of our epistemological capabilities: the greater our significance to the Cosmos, the greater our powers.

Is it entirely unreasonable to suspect that similar differences in fundamental attitude vis à vis the world and man's cognitive abilities might still colour the realist dispute in science in the 20th century? As Ian Hacking has said in *Representing and Intervening*, scientific realism and scientific anti-realism are schools of thought more correctly characterised by differences in general attitude than by particular points of doctrine. Certainly no one would claim that parties to this dispute are closet theologians masquerading as philosophers. Such a claim would miss the point. Our presentiments about the quality of the world for man remain forever present even if they are not given theological garb. The theological garb, in this case at least, is not ultimately what is important. What is important about the theological connections disclosed by Blumenberg is that they point to something

behind our arguments, to something that has not been discussed openly, namely, the personal complexion of the individual thinkers in our debate. This might explain why so often debates in this area are peppered with *ad hominem* remarks and highly emotive language.<sup>36</sup>

I hope it is now at least plausible to assume that the connections between theology and science are closer than is commonly assumed, and that the influence of theology has been felt in the sciences. We have detected traces of the influence of theological ideas in the work of Quine and Cartwright, and gone on to identify a number of important connections between the scientific enterprise, the understanding of that enterprise, and theological matters. Epicurus, Dales and Thorndike have pointed out the similar origins of theology and science. Whitehead and Dampier have suggested that medieval theology in particular provided the assumptions necessary to make the modern scientific enterprise conceivable. Foster and Hooykaas have argued that the difference between pre and post revolutionary science is in large measure due to the changes in the prevailing theological commitments of the scientists themselves. Grant and Blumenberg have shown that theological commitments have affected the realist dispute in science at crucial moments in the history of science. And Kuhn has highlighted similarities in the role of authority in 'normal' scientific and theological practice; a similarly conservative agenda; and the psychological similarity between paradigm shifts and conversion experiences. Now given these points of contact between theology and the sciences, it is perhaps not unreasonable to suggest that a theologian might have something to bring to our realist dispute in science.

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<sup>1</sup> This should not be taken as a suggestion that historical factors are unimportant in philosophical discussions; precisely the reverse is the case, as I hope will become apparent in the course of this chapter. The point is that Aquinas' significance is not confined to historical matters alone.

<sup>2</sup> In *Science and the Middle Ages*. Ed. David Linberg. Chicago: University of Chicago Press, 1978, p.114.

<sup>3</sup> R. Harré, *The Philosophies of Science: An Introductory Survey*. London: Oxford University Press, 1972, p.135.

<sup>4</sup> *La Théologie comme Science au XIII Siècle*. Paris, 1978.

<sup>5</sup> See Mary Midgley's *Science as Salvation: a modern myth and its meaning*. New York: Routledge, 1992. and *Quantum Cosmology and the Laws of Nature: Scientific perspectives on Divine Action*, edited by Russell, Murphy and Isham, Vatican City



State: Vatican Observatory Publications, 1993.

<sup>6</sup> Quine, *Pursuit of Truth*. Cambridge, Mass.: Harvard University Press, 1990.

<sup>7</sup> Oxford: Clarendon Press, 1983.

<sup>8</sup> *Ibid.*, p. 19.

<sup>9</sup> *The Structure of Scientific Revolutions*. Second edition. Chicago: University of Chicago Press, 1970.

<sup>10</sup> Lakatos, 'Falsification and the Methodology of Scientific Research Programmes', in *Can theories be Refuted?* Ed. Sandra Harding. Boston: D. Reidel Publishing Co., 1976, p.93.

<sup>11</sup> *The Structures of Scientific Revolutions*, p. 136.

<sup>12</sup> *Ibid.*, p. 164.

<sup>13</sup> *Ibid.*, pp. 165-6.

<sup>14</sup> Here I rely on Emil Fackenheim's, *God's Presence in History*. New York: N.Y.U. Press, 1970.

<sup>15</sup> These passages were found in *A Guide to Happiness*, a Phoenix Paperback edition of selections from *The Epicurean Philosophers*, edited by John Gaskin and published by Everyman.

<sup>16</sup> *Ibid.*, p. 18.

<sup>17</sup> Richard Dales, *The Scientific Achievement of the Middle Ages*. Philadelphia: University of Pennsylvania Press, 1973, p. v.

<sup>18</sup> We should also bear in mind that many early scientists were rumoured to be dabbling in the occult sciences. We must remember that in the earliest days of science it was practically impossible to separate science from religion, medicine, astrology, divination, alchemy, and the investigation of the magical properties of herbs and gems. See Thorndike's *History of Magic and Experimental Science*, in particular vol. 1, First Thirteen Centuries. New York: Columbia Press, 1923.

<sup>19</sup> Hooykaas, *Religion and the Rise of Modern Science*. Edinburgh: Scottish Academic Press, 1972, p. xiii.

<sup>20</sup> See Foster's 'The Christian Doctrine of Creation and the Rise of Modern Natural Science', in *Mind*, vol. 43 (1934), pp 446-468, and Hooykaas.

<sup>21</sup> Cambridge: Cambridge University Press, 1932, p. 15.

<sup>22</sup> Dales, p. 171.

<sup>23</sup> Consider the difference in attitude regarding the worth of the natural sciences displayed by the likes of Plato and the early patristic commentators concerning the opening chapters of *Genesis*. Basil, Ambrose, Origin, all were motivated by scientific curiosity to undertake their studies of the account of creation in *Genesis* (See Thorndike, p.489). It is true that many, such as Augustine, did not encourage scientific work; but this was often due to fears that adherents were dabbling in the occult (especially astrology), or neglecting their own salvation while pursuing scientific studies.

<sup>24</sup> Edward Grant, *Physical Science in the Middle Ages*, New York: John Wiley & Sons, 1971, p.85-6.

<sup>25</sup> *Ibid.*, p.87.

<sup>26</sup> See also Alexandre Koyré's 'The Origins of Modern Science: A new Interpretation', in *Diogenes*, XVI, 1956. He writes: "...it was in a revolt against this traditional defeatism (of the Scholastics) that modern science, from Copernicus. . . and up to Galileo and Newton, accomplished its revolution against the shallow empiricism of the Aristotelians, a revolution based on the deep conviction that mathematics was much more than a mere formal device for ordering data; in fact, the very key for the understanding of Nature" (p.18).

<sup>27</sup> Grant, p. 89, and p. 90.

<sup>28</sup> *Ibid.*, p.87.

<sup>29</sup> Hans Blumenburg, *The Genesis of the Copernican World*. Trans., Robert Wallace, Cambridge Mass: the MIT Press, 1987.

<sup>30</sup> Copernicus, *On The Revolutions of the Heavenly Spheres*. Trans. by A.M. Duncan.

New York: Barnes and Noble Books, 1976.

<sup>31</sup> Ibid., p.25.

<sup>32</sup> Ibid., p.25.

<sup>33</sup> Blumenburg, p. 172.

<sup>34</sup> See Blumenberg's *The Legitimacy of the Modern Age*, Cambridge Mass: The MIT Press, 1983.

<sup>35</sup> Both taken from *Philosophy in the Middle Ages*, edited by Hyman and Walsh. Indianapolis: Hackett Publishing Company, 1973. p.388-9.

<sup>36</sup> Consider Koyré's comment, quite common in realist circles, that Positivism, or scientific anti-realism, is the 'child of failure', and that Copernicus revolted against 'traditional defeatism' of the 'shallow empiricism of the Aristotelians', and was himself inspired by a 'deep conviction' that mathematics could unlock the secrets of nature (in 'The origins of Modern Science', *Diogenes XVI*, 1956, p.17-18). Compare these emotive comments with those of Grant, who found in late Scholastic anti-realism, a 'sophisticated positivist attitude', and Copernicus to be 'naive'. Crombie, in his study of Grosseteste, also quotes with approval the latter's anti-realist stance in science (p.108), and later calls him 'the first great English scientist and philosopher of science' (p. 115), in *Robert Grosseteste*, edited by D.A. Callus, Oxford: Clarendon Press, 1955.

## **Chapter 2**

### ***The Divisions of the Speculative Sciences***

Le 'principe-commencement' de la philosophie thomiste n'est autre en effet que la perception sensible des êtres concrets actuellement existants. Tout l'édifice d'un savoir de type thomiste, de la plus humble des sciences jusqu'à la métaphysique, repose donc sur cette expérience existentielle fondamentale, dont la connaissance humaine ne cessera jamais d'inventorier de plus en plus complètement le contenu.<sup>1</sup>

In two these sentences Etienne Gilson has drawn the basic outlines of the Aristotelio-Thomist scientific project. Beginning from the sensory perception of concrete individuals, Aquinas fashions all the speculative sciences from physics to metaphysics. Such a system is of special interest to us precisely because its starting point coincides with the conclusions reached in Part I: the terms which cross translation determinately are terms referring to concrete individuals. It is of particular interest, therefore, to see how Aquinas and Aristotle construct a science from these humble beginnings, beginnings which are a part of what I have been calling a 'species-specific conceptual scheme'. In this chapter I will examine how the various sciences are carved out of the sensory data and distinguished from each other. In the following chapter I will discuss the cognitive status Aquinas assigns to each of the particular sciences, with emphasis on natural science and theology. These two tasks completed, we will be in a position to return to our original realist dispute in science armed with the intellectual apparatus of Aquinas. Parallels and analogies can then be found between our theoretical sciences and the Thomist edifice. In so doing our modern theories are cast in a different, and I will argue, revealing light.

#### *Science of the Natural World in Ancient Greek Philosophy*

When faced with the task of understanding any philosophical system it is vital that one be familiar with the intellectual context in which it was born. In particular one needs to know the specific set of problems to

which the given system is a response. Now in the case of Aquinas it is clear that he inherited his scientific problems from Aristotle. But Aristotle's scientific work is itself intelligible only when seen as a continuation of the efforts of the Presocratics. Fortunately the relevant features of this intellectual background are generally well known, and can be painted with a minimum of brush strokes. I will confine myself then to the briefest of summaries of the problems Aristotle inherited from his predecessors, touching only those points needed to contextualise Aquinas' philosophy of science.

It is generally agreed that the ancient Greek philosophers were the first to abandon mythical or magical theories of nature in order to develop descriptions of the natural world 'according to the categories of human reason'.<sup>2</sup> From the earliest attempts of the Presocratics at rational description of nature two distinct but fundamentally related problems arose. In fact one could say these problems are two aspects of the same difficulty. What most impressed the Ionians about the world in which they found themselves was that everything it contained appeared to be in constant change. This lack of stability, the constant process of coming to be and passing away, was the chief characteristic of everything in the Ionian realm of experience. In fact nature itself came to be defined at least in part in terms of change, as is made clear in Aristotle's *Physics*.<sup>3</sup> The metaphysical difficulty raised by change was the need to explain how a single object could be in constant change and yet remain in some real sense the same thing. The same could apply to the world as a whole; the endlessly repeating cycles observed at all levels of the natural world, in the stars, in the seasons, in the life cycles of plants and animals, suggest the world as a whole is eternal and ageless, yet always in the process of renewing itself. The early Ionians approached this problem by positing a basic element, be it water, air, fire, the unbounded, etc., from which everything in the natural world is somehow derived. In so doing the Ionians could begin to see each concrete individual and process in the world as a modification of a basic element which itself is eternal and abiding beneath all apparent changes.

By stating the metaphysical aspect of the problem of change as we have

done we have already hinted at the related difficulty. The accompanying difficulty was the epistemological matter of understanding how knowledge of the natural world is possible at all when it is in constant change.<sup>4</sup> The problem is that knowledge claims in the strict sense were expected to embody eternal and necessary truths; but the stability required of a knowledge claim appears incompatible with a constantly changing world. A statement which is true only here and now, or at some other specific time and location, did not qualify as scientific knowledge for the Greeks any more than it does today. Scientists of all ages want to isolate the unchanging aspects of nature, those aspects of things and processes that must be true in all places and at all times. But if the natural world is in constant change it becomes problematic as to whether it is ever possible to say anything about it that is always and necessarily true. However, the solution to the metaphysical problem of change could be applied with equal success to its epistemological counterpart: posit an eternal, abiding element underlying change and make it the focus of investigations. Although the individual modifications of the basic element are ephemeral and in constant change, the basic element itself endures beneath these changes. Moreover, one could imagine a set of fixed laws governing the changes this element could undergo. The stability of the element and the fixed nature of the laws governing its processes are precisely the sorts of things about which true statements could be formed. We see then that the metaphysical and epistemological problems are really components of the same difficulty: Understanding a world in constant change according to the categories of human reason. Both aspects of the problem of change can be dealt with by focusing on the stable, abiding features or components of a changing world.

But despite the positing of an underlying basic element and the possible co-operation of metaphysics and epistemology, there was no unanimous agreement among the Presocratics that their efforts to understand the natural world were bound to be successful. In fact the essential co-operation of metaphysics and epistemology was scuttled on two well known occasions, and in each case the result was the same, namely, that natural science could not be pursued with profit. Heraclitus was interpreted to be making the metaphysical claim that there is no

stability anywhere in nature for the scientist to fix upon. Given this assumption, one is irresistibly driven to the conclusion that Wisdom lies in recognising the futility of the scientific project. Now, as is made clear in Kirk, Raven and Schofield, it is highly unlikely that Heraclitus actually held this view. In fact there is evidence that Heraclitus thought that there was some degree of coherence underlying all changes, as is clear from the fragment: 'all things happen according to the Logos'.<sup>5</sup> Indeed it is precisely this Logos, or 'common plan or measure' that escapes the attention of ordinary mortals but has been recognised by Heraclitus. But whatever the actual views held by Heraclitus, it is equally clear that his position on change was thought to imply the impossibility of knowledge of the natural world.<sup>6</sup>

At the other metaphysical extreme was Parmenides, he of the notorious denial of the metaphysical possibility of change.<sup>7</sup> According to Parmenides, Reason dictates that nature, or Being, is one, unified and immutable, and it is only the deception of the senses that leads us to think that all things are in a state of flux. The epistemological consequence of this position is that any stable knowledge claims will stem from *a priori* reasoning about how nature must be. No profitable empirical investigation of nature is possible because the senses do not reveal nature as it is but only as it appears to be. Rather than seeking to describe nature after it has revealed some part of itself to the investigator, Parmenides will prescribe how nature must be according to the dictates of Reason and ignore how nature reveals itself to us. It is clear then that the two extreme positions on the metaphysical problem of change lead to the same epistemological result although for different reasons: no *a posteriori* knowledge is possible of the natural world, and consequently natural science cannot be pursued with profit either because there is nothing in the world to know in the strict sense, or because we are not equipped to carry out investigation of the world because the senses are unreliable.

Plato fully appreciated the force of the uncomfortable conclusions reached by Heraclitus and Parmenides; but rather than accept either's metaphysical position (the source of the difficulties) he attempted to solve the epistemological problem by reconciling the two incompatible

metaphysical positions which led to the epistemological disasters. He does this by positing a world of appearance which is subject to constant change (the world of Heraclitus) and a world of immaterial and immutable Forms (the world of Parmenides). The interesting epistemological result is that while we cannot have perfect knowledge of the world of appearance, theoretically we can have indirect knowledge of it via the Forms. Insofar as each concrete individual in the world of appearance is an imperfect copy of the eternal and immutable Forms, there is a stable element within the natural world that can be a source of intelligibility. In other words, Plato solves the epistemological problem caused by the lack of stability in the natural world by finding stability in another realm to which the world of appearance is related. Plato's reflections then naturally focus on how knowledge of the Forms can be attained (at least until he comes to recognise the serious difficulties of his position in the *Parmenides* and later works).

This is the intellectual context in which Aristotle finds himself, and in which his thought becomes intelligible. Aristotle is in agreement with Plato on at least three fundamental points. He accepts, a) that there are stable elements to be found in the concrete individuals encountered in the world of appearance, b) that the stability is found in the Forms of concrete individuals, and c) that we can come to know them, although the account of how this is possible differs radically from that of Plato. Again this shift in epistemology is motivated by a change in metaphysics. For Aristotle cannot accept Plato's metaphysical position which includes a division between a world of appearance and a separate world of reality, and the claim that the Forms enjoy an independent existence apart from the world of concrete individuals. Aristotle does away with Plato's distinction between the world of appearance and the world of Forms by locating the Forms within the fully real world of mutable, concrete individuals. In effect Aristotle is claiming that stability can be found in the world which our senses reveal to us, and that this realm knowable at least in part. Although it remains true that each individual is finite and in constant change, there are aspects of each individual, its Form for instance, which are not subject to the conditions of each particular instantiation of the Form. For example, Aristotle can say that what it is to be a human being is eternal and

stable, even though individual human beings are finite and in constant change. Hence the Aristotelian project adopted by Aquinas: isolate and focus on the stable aspects of concrete individuals to the exclusion of their accidental, particular and changeable features. This process of isolation is called Abstraction. We must now consider this intellectual operation in some detail, for it is by means of abstraction that the various sciences are discovered and distinguished.

### *The Intellectual Operation of Abstraction*

We can take the following formal statement as a starting point in our investigation of the intellectual operation of abstraction and proceed by analysing its components: *Abstraction is an operation of the agent intellect by which it produces an intelligible object proportional to the intellect.* In order to understand this statement we must address ourselves to four basic questions. First, we need to know in general terms what it means to abstract something. To this end I will begin with a brief discussion of what I will call the 'focal' sense of abstraction. Second, we must be clear about what constitutes an 'intelligible object'. This discussion will also involve mention of the agent intellect and its role in abstraction. Third, we need to understand what one abstracts *from*. And finally, we need to determine how many kinds of abstraction the agent intellect is capable of effecting on the data of the senses, and how these abstractions differ.

### *The Focal Sense of Abstraction*

'Abstraction' is a difficult term to define in a simple, straightforward, and uncontroversial fashion, as is only too evident from the extensive and heated discussions amongst Thomists on this matter following Wyser's critical edition of Questions 5 and 6 of the *De Trinitate* in 1947-8.<sup>8</sup> These discussions have been heated at times because much hangs on the interpretation of Aquinas' understanding of these matters, as will become clear in due course. However, our present difficulty does not arise from the obscurity of this operation *per se*, but rather from the



fact that the term 'abstraction' is used by Aquinas to refer to a number of distinct, but related, operations. Fortunately there is a general or 'focal' sense of abstraction on which the technical senses are based, the technical senses being refinements of the general process of abstraction. A few words on the focal sense of abstraction will suffice for the moment. The related technical senses will occupy us in detail later when we descend into the particulars of Aquinas's division of the sciences. Broadly speaking then, abstraction occurs whenever the intellect isolates an aspect or feature of an individual for consideration to the exclusion of everything else. In most cases 'to abstract' means to consider separately particular aspects of an individual. Aquinas explains:

. . . we must note that many things are joined in [a] thing, but the understanding of one of them is not derived from the understanding of the other. Thus white and musical are joined in the same subject, nevertheless the understanding of one of these is not derived from an understanding of the other. And this one is understood as abstracted from the other.<sup>9</sup>

To use another of Aquinas' examples, the intellect can consider the colours of objects, and reach an understanding of colours, without paying attention to coloured objects, or to the situation in which these objects find themselves.<sup>10</sup> For example, we can focus on, and come to understand, the redness of an apple without focusing on or understanding the apple itself, or the relation of the apple to other things. This is possible because the set of elements that would feature in a definition of colour does not include statements about apples or their environment. In effect, the intellect is able to 'disengage' or 'separate' colours off from the rest of the data of sense experience and study them in their own right to the exclusion of everything else. Such an operation provides the focal sense of 'abstraction'.

### *The Product of Abstraction: The Intelligible Object*

We can now turn to the matter of the product of abstraction, the 'intelligible object', and the mechanism by which it is produced. We can

approach these topics best via Thomist psychology; for in order to understand this operation of the intellect, we must have some familiarity with the faculty which performs it. Again I confine myself to the barest of essentials, i.e., those required for understanding the operation of abstraction.

Psychological studies generally are hampered by the fact that its object of study, the 'mind', 'soul' or 'psyche', is not directly observable. Aquinas emphasises this fact by pointing out that the intellect only come to be aware of itself and its nature by first becoming aware of its activities.<sup>11</sup> Consequently, Aquinas, like everyone else, is forced to study the soul indirectly, attributing different cognitive 'powers' or 'capacities' to the intellect in order to account for its activities. His methodology is based on the assumption that ". . .no action belongs to anything except through some principle formally inherent therein. . ."12 This is an important methodological procedure which must be recognised if one is to appreciate the nature of Aquinas' philosophical reflections. Aquinas' psychology, epistemology and metaphysics all take the form of what we might call a Transcendental argument. Aristotle and Aquinas *assume* that human beings are capable of performing certain actions (because they are seen to perform them). The task of philosophical enquiry is then to state what must be the case in order for these actions to be possible. Now the leading assumption behind the philosophical reflections of both Aristotle and Aquinas, expressed in modern terminology, is that human beings are capable of uttering true statements about the world, and that these utterances can be understood by other competent language users.<sup>13</sup> Thomist psychology is then a part of this broader philosophical project of explaining how human beings can utter such statements about the world and be understood by others.

Now among the cognitive powers of the human psyche Aquinas finds the purely *passive* ability to receive sensory impressions from objects outside the mind. Another power is memory. Another is the psyche's *active* ability to perform intellectual operations on the data received through the senses. After sensory data (phantasmata) have been received and subsequently committed to memory, the psyche can

retrieve these experiences to consciousness and subject them to various operations, one of which is abstraction.<sup>14</sup> The 'power' of the psyche which performs this active operation is called the *agent intellect*. Now the particular activity or power referred to by the term '*agent intellect*' which concerns us is the psyche's ability to construct definitions from the sensory impressions retrieved from memory.<sup>15</sup> The construction of definitions is part and parcel of what Aquinas calls 'the first act of the intellect', otherwise known as 'simple apprehension'. In the act of simple apprehension, or the understanding of indivisibles as it is sometimes called, the intellect "*apprehendit essentiam uniuscuiusque rei in seipsa*"<sup>16</sup>, the intellect 'grasps', or 'apprehends', the essence of a thing in itself. Of course, as will become apparent later, Aquinas does not think that in order to know the essence of an object one has simply to clap eyes upon it. What he does think, and this is how we should understand simple apprehension, is that in this act the intellect is able to *identify* an object given in sensation *as being the sort of thing it is*. In other words, in the first act of the intellect the psyche is able to begin the process of defining *x* by determining *what kind* of thing *x* is. It is in this sense that the intellect grasps the essence of *x* in simple apprehension. Consequently we can say that the term '*agent intellect*' is used to refer to that power of the psyche to identify and to classify the concrete individuals it has encountered. As we shall see, this ability to identify an individual as being of a certain kind is a process made possible by the fact that the agent intellect can abstract.<sup>17</sup> It is also worth noting in passing that simple apprehension is called the first act of the intellect because it is the act upon which all further cognitive acts are based. The definitions made possible by simple apprehension and abstraction will be used later in the construction of propositions and demonstrations.

Let us now turn to the product of abstraction, to the notion of an 'intelligible object'. I have already mentioned that the Aristotelian project is characterised by the attempt to isolate and focus on the stable features of the world of sensory experience. It is these stable features found within the constant flux of the natural world that are said to be strictly 'intelligible'. Technically one can say that an 'intelligible object' is simply *that about which there can be the activity of the agent intellect*,

*viz.*, that of which the agent intellect is able to construct a definition.<sup>18</sup> If we remember that knowledge of the world of experience is made problematic by the fact that it is in constant change we will begin to see why the definition of a mutable individual is intelligible while strictly speaking the individual itself is not. The attraction of a definition is that it captures what is stable and enduring about the individual defined. In particular, a definition expresses *what* something is, its essence or nature; for what an individual is remains constant even though the individual changes. And the essence of the individual endures even though each instantiation of it comes to be and passes out of existence. If this were not the case there would not be *change* in the world of experience, merely *constant replacement* of one sensory stimulus by another (a feature placing world). Once in possession of a definition the intellect can then proceed to construct demonstrations using the definition as the middle term to unite a predicate to, or divide it from, a subject term.

But of what is the intellect able to construct a definition? What conditions need be met before this activity can take place? This question is best approached by considering what *cannot* be defined. That which cannot be defined, that which is not strictly intelligible, is the absolutely unique individual. This follows from the nature of the process of understanding itself. The intellect comes to understand an object or process *x* by identifying its similarities and differences to other objects and processes encountered in the world of sensory experience. The intellect understands *x* when it can see that *x* is like *a*, *b* and *c*, and unlike *m*, *n*, and *o*; in other words, when *x* can be seen as a member of a certain kind, and as such distinct from objects of other kinds. But that which fits into no kind whatsoever is strictly unintelligible. If the intellect is faced with an individual or process *x* with absolutely no similarities to anything encountered in its past experience, the intellect, if it notices *x* at all, will not be able to understand it. Only by assimilating it to other objects will the intellect begin to grasp *x*. These aspects of the nature or process of understanding are brought out clearly in the nature of definitions. The intellect defines *x* by assigning to *x* a genus and specific difference, - i.e., it determines in what way *x* is like other things, thereby fixing the genus, but different, thereby fixing

the species.

From the foregoing we can determine that there are two things which the intellect cannot define or make intelligible. As already mentioned, there is that which fits into no genus or species. If the intellect can form no idea of *what x is*, it is impossible for the intellect to understand it. But more importantly for our purposes is the recognition that the particular member of a species (a concrete individual) in its concrete particularity is not strictly intelligible either, even though it is clearly like other things and different from others. It is clear why the intellect cannot define and make intelligible that which fits into no genus or species. It is more important, however, that we be clear on why it is that the intellect cannot make intelligible a concrete individual in its individuality. The intellect is indeed able to understand a concrete individual's *general or universalisable* features, its genus and specific difference for instance, for these features are contained explicitly or implicitly in its definition. But there is no definition of an individual *qua* individual, for in this case the individual is absolutely unique. As Aquinas says, there is a definition, and therefore an understanding of Man; but strictly speaking there can be no definition of Socrates.<sup>19</sup> Insofar as Socrates is a man, he is intelligible; insofar as he is Socrates, i.e., this particular man, he is not. Insofar as Socrates has features which he shares with other individuals, like humanity for instance, he is intelligible as a member of a certain species in a particular genus. Those features which Socrates shares with no other entity, however, those which allow the intellect to distinguish Socrates from everything else, including other members of the same species, are those which make him an absolutely unique individual not amenable to definition. As we read in the *Summa Theologiae*, it is proper for the human intellect to know individual existing things, but not as individuals.<sup>20</sup>

*From what does the agent intellect abstract?*

Again we can take as our point of departure a simple formula and proceed by analysing its contents. Abstraction always begins with, and proceeds from, concrete individuals and their conditions of

particularity.<sup>21</sup> Why it is that the intellect needs to abstract from particulars and their conditions of particularity is clear enough from our discussion of definitions. The concrete individuals as such is not strictly intelligible, and hence is not strictly definable because, a) concrete individuals are subject to change while definitions are stable, and b) concrete individuals are absolutely unique and definitions are of universals. Consequently, when abstracting the intellect must leave out of consideration that aspect of an individual responsible for its mutability and uniqueness. But what is responsible for an individual's mutability and uniqueness? Why are individuals mutable and absolutely unique?

The Aristoteliio-Thomist position on this matter is well known. What makes one individual, a human being for example, distinct from another human being, or one oak tree from another oak tree, is the parcel of matter that makes up its body. Matter is the principle of Individuation. This is a central component of the Aristotelian theory of hylomorphism which states that particular individuals are a combination of *Substantial Form* and *Primary Matter*. The Substantial Form is that component or aspect of  $x$  that makes  $x$  the kind of thing it is; its Matter is that component of  $x$  that distinguishes it from others of its kind and makes it a unique individual. Consequently, to say that abstraction is from concrete individuals and their conditions of particularity is to say that the agent intellect abstracts from Matter, and those aspects of an individual which follow from its having a private parcel of Matter. This point cannot be over-emphasised as it is fundamental to Aristotliio-Thomist scientific thought: Matter is the source of unintelligibility in virtue of the fact that it is the cause of both change and uniqueness in the world of experience.

The thinking behind the claim that matter is the cause of change need not overly concern us here. It is enough that we recognise that this association was accepted by Aristotle and Aquinas. As for the problem caused by the unintelligibility of unique individuals, we have seen why it must also be laid at the door of matter, the principle of individuation. So we can say that if  $x$  is a material body (and every thing encountered in sensation is a material body of some description or an accident

thereof) two epistemological difficulties immediately arise:  $x$  is mutable and absolutely unique. Consequently, if one is seeking to make  $x$  intelligible one must somehow counteract the influence of matter. This is precisely what the agent intellect accomplishes by abstracting intelligible features from material bodies, i.e., by considering aspects of material bodies to the exclusion of their materiality. In the process of abstraction the abstracted intelligible object is seen to exist in some sense apart from matter. How this is so will become clearer upon consideration of the various kinds of abstractable intelligible objects and the two modes of abstraction.

### *Different Abstractions mean different Sciences*

Now that we have an understanding of the focal sense of abstraction and of the related concepts of intelligible object and agent intellect, and we see how this intellectual apparatus was developed in response to epistemological difficulties encountered by the Presocratics, we are finally in a position to examine how Aquinas puts these ideas to work in the divisions of the sciences. But as we proceed with this new topic, it is vital to bear in mind that each of the sciences deals with different aspects of essentially the same basic material - concrete individuals given in sensation. The sciences are distinguished according to *how* this common material is dealt with by the intellect, under what aspect, or from what point of view. As Leroy has said, '. . .les diverses formalités dont l'être sensible est porteur ne se dévoilent pas au même regard, ne se manifestent pas sous la même lumière'.<sup>22</sup> As the agent intellect adopts now one, now another point of view, it produces or disengages a distinct types of intelligible object from the realm of sensory experience. So by distinguishing the different types of abstracted intelligible objects, each of which is produced by a distinct type of abstraction and point of view, Aquinas is able to distinguish one science from another. It is to these types of abstraction that I now turn.

Aquinas distinguishes three species of abstraction, three species of intelligible object, and consequently three species of speculative science. At the beginning of this chapter I discussed what I called the focal sense

of the term abstraction. It is now necessary to look at the more precise technical senses of this term in order to understand the basis of the distinctions between the sciences.

The intelligible objects of the speculative sciences differ with respect to their *ontological status*; for  $y$  can be abstracted from  $x$  either in the order of being, or merely in the order of the understanding, or in both at once. Intelligible objects are then said to differ according to the *degree* to which they are abstracted from matter. As we shall see, some intelligible objects are metaphorically speaking 'closer' to matter than others. This distinction focuses on the extent to which matter is crucial to the understanding of the intelligible objects. The details of these refinements in the meaning of abstraction will occupy us for the rest of this chapter.

The best place to start when embarking on a detailed study of Aquinas' theory of abstraction is simple apprehension and the other acts of the intellect. We have already come across the first act of the intellect in our discussion of the agent intellect and the nature of definitions. Now we require some familiarity with the remaining acts because all species of abstraction are particular operations of the intellect performed in either the first or the second of its three possible acts. More importantly, the act of the intellect in which an abstraction is performed determines the *ontological status* of the intelligible object, the first of our distinctions. Again, the briefest sketch of these acts will suffice for our purposes.

As mentioned above, the first cognitive act of the intellect, the act upon which all the remaining cognitive acts depend (including the intellectual operations of abstraction) is called 'simple apprehension', (*apprehensio simplex*). This is the act whereby the intellect recognises and grasps the nature or essence of a concrete individual. The second act of the intellect is called 'judgement' (*iudicium*) and is characterised by the processes of composition and division. In Scholastic terminology one is said to 'compose' when one forms an affirmative proposition by predicating something of a subject term. In this case there is a bringing together of a subject and a predicate. By contrast, one is said to 'divide'



when one forms a negative proposition by separating or dividing a predicate from a subject term. The interesting feature of judgements for our present purposes is that they are used to assert something about the existence of the nominata of the subject and predicate terms. For example, by uttering the proposition 'Socrates is musical' one asserts that musicality, or more precisely, the property of being musical, actually exists in Socrates, that musicality and Socrates are found together. On the other hand, if one says 'Socrates is not Plato', one is asserting that neither Plato or Socrates exists in the other; they exist apart, independent of, and separate from, one another. Now the crucial distinction for our purposes between the act of judgement and simple apprehension is that in the former the intellect asserts or denies something concerning the existence or state of  $x$ , whereas in simple apprehension the intellect simply grasps what  $x$  is. We can say that in simple apprehension the intellect focuses on the *nature* of the particular intelligible object under consideration, while in judgements the intellect focuses on *the mode of existence* of a particular intelligible: it looks at whether  $x$  exists with or apart from  $y$ , where  $x$  is a subject term and  $y$  a predicate.<sup>23</sup> The importance of this distinction will emerge in due course.

The third and final act of the intellect is called reasoning (*ratiocinatio*). In this act the intellect moves from two or more propositions (now serving as premises) to a conclusion by means of an accepted rule of inference. This particular act is not of concern to us insofar as we are seeking to understand the three species of abstraction. Nevertheless a few words on it will not go amiss because it is a crucial element of the cognitive process generally. Only when all three acts of the intellect are used in conjunction does scientific knowledge come to exist in the knowing intellect: simple apprehension provides the intellect with the content of our subject and predicate terms (the nature of those objects picked out by these terms); in judgements these terms are put together to form propositions; by reasoning the propositions can then be combined to produce arguments and conclusions. It is towards the production of such conclusions that all the efforts of the scientist are committed.

With this background in mind we can make sense of Aquinas' initial division of abstraction into two categories. He writes:

Abstraction can occur in two ways. First, by way of composition and division, and thus we may understand that one thing does not exist in some other, or that it is separate from it. Secondly, by way of simple and absolute consideration; and thus we understand one thing without consideration of another.<sup>24</sup>

We see here that strictly speaking abstraction can occur in either the first or the second act of the intellect. Now the crucial difference between abstractions in the first act of the intellect from abstractions in the second is that they produce intelligible objects of significantly different ontological status. When abstraction occurs in the first act of the intellect the result is an intelligible abstracted from matter in the understanding alone, *but not in the order of being*. To take an example already used, the intellect can isolate and consider the nature of the colour of an apple without considering the material apple itself (abstraction in the order of the understanding); but colours cannot exist apart from coloured objects although they can be understood without reference to them (colours cannot be separated from material objects in the order of being). Now, if abstraction occurs in the second act of the intellect, the result is an intelligible object abstracted from matter in the order of the understanding *and in the order of being*. Such an object can actually exist apart from matter. Just what sort of things these intelligible objects are will be discussed when we come to consider the science of metaphysics.

But despite this important ontological difference between the intelligible objects of abstractions in the first and second act, there is an equally important sense in which abstractions in the first and second act are fundamentally alike. All intelligible objects abstracted by the agent intellect, regardless of ontological status, are intelligible precisely because they have been abstracted from the particularising conditions of matter. However, there are degrees of distance, so to speak, at which the intelligibles are found from these particularising conditions. Some intelligible objects cannot be understood without some reference to

matter, nor can they exist without matter. Some can be understood without reference to matter, but they cannot exist without matter to support them. Finally, some intelligible objects can be understood without reference to matter, nor do they depend on matter for their existence. As we move from the first intelligibles to the last we are moving further and further from the particularising conditions of matter. These levels are called the three degrees of abstraction. At each degree there is a particular kind of intelligible object, and for each kind of intelligible there is a distinct science. We can now consider the nature of each species of abstraction and its corresponding intelligible object.

### *First Degree of Abstraction: The Natural Sciences*

The first degree of abstraction occurs in the first act of the intellect. In the act of simple apprehension the intellect focuses on the nature of the objects given in sensation; and the intelligible object abstracted in this case is the nature or essence of the concrete individual as a whole which is then expressed in a definition. It would be easy to assume that this operation abstracts the substantial form of the individual. This would be a mistake, however. For the substantial form of  $x$  is that component of  $x$  which makes  $x$  the kind of thing it is, and as such does not include matter - for matter only makes  $x$  a particular instantiation of a kind, it does not determine what kind of thing  $x$  is. But if  $x$  is a material body, as would be the case if  $x$  is a human being, or dog or oak tree, then it would be incorrect to say that its nature is entirely free of matter. For to be a human being, or a dog or oak tree, is to be a material body of a particular sort. To mark this distinction clearly we can use the Latin terms *forma totius* and *forma partis*, and use human beings as an example to see how these terms are applied. The *forma totius* is the nature or essence of a human being as expressed in a definition. Human beings, in Thomist philosophy, are defined as a composite whole made up of a rational soul and material body. The *forma partis*, or substantial form on the other hand, is that part of a human being that makes it specifically human, i.e., its rational soul. The soul is the form of the body, and as such is only a part of the

definition of human being. Consequently we must say that in the first degree of abstraction the intellect abstracts the whole nature of the individual under consideration, i.e. its *forma totius*, not its substantial form or *forma partis*. This first degree of abstraction is known therefore as *abstractio totius* because it abstracts or disengages the nature of the entire object given in sensation.

It will be noticed that the definition of human being, its *forma totius*, includes matter. But if intelligible objects are to be abstracted from matter how is it that matter remains an essential component of the intelligible object? To explain how this problem arises and how Aquinas deals with it let us return to the case of human beings and examine how the intellect approaches this object. After the intellect has had sensory experience of a number of individual human beings the agent intellect abstracts from these experiences the essential features of the species. That is to say, it leaves out of consideration the accidental features of Socrates or Plato that, while making them Socrates or Plato, are nevertheless not included in the definition of human beings *qua* members of the species. Such features include height and weight, hair, skin and eye colour, dates of birth and death and other details of personal history, etc. These extraneous, or accidental features are grounded in the fact that each individual has its own parcel of matter in which the form of humanity has been instantiated. Consequently the intellect must abstract from precisely this matter. However, the complication arises that human beings are essentially material entities, albeit with a distinct form, viz., a rational soul. So if the intellect is to properly understand human beings, its definition of human being must include some reference to matter. This is what is meant by saying that in the first degree of abstraction the intellect disengages an intelligible object that cannot be understood without reference to matter. It is of the essence of being human to be a material body of a sort. A non-material human being is a contradiction in terms and corresponds to nothing in the world.

To cope with this situation Aquinas is obliged to introduce distinctions in the concept of matter. He calls that matter which is responsible for individuating concrete particulars from other members of their species

*individual sensible matter*: 'individual' because each human being has its own parcel of matter; 'sensible' because the matter of each human being is given in sensation. This distinction is pressed into service in the following manner. Socrates and Plato each have their own body, and hence have this or that particular parcel of matter. But human beings, while necessarily having flesh and bones, do not have Socrates or Plato's flesh and bones. So Aquinas says that the definition of human beings (and of other natural kinds) includes reference to what he calls *common sensible matter*: 'common' because humans have flesh and bones in general, but not any specific flesh or bones; 'sensible' because flesh and bone are materials given in sensation. So we must make more precise our understanding of *abstractio totius*: in this case the intellect does not abstract from all matter, but only from individual sensible matter.<sup>25</sup> Therefore, *abstractio totius* is that operation of the agent intellect whereby individual sensible matter, but not common sensible matter, is left out of consideration when the intellect turns its attention to particular instantiations of natural kinds. The intelligible objects revealed by this type of abstraction are the natures of material, mutable individuals. These are the objects of natural philosophy. They are those entities that, while abstracted from individual sensible matter, cannot be understood without common sensible matter being included in their definition; nor can such entities exist apart from matter. Accordingly Aquinas says that such intelligible objects rise above the conditions of unintelligibility by the lowest degree possible.

### *Second Degree of Abstraction: Mathematics*

The second degree of abstraction also occurs in the first act of the intellect. Consequently the intelligible objects produced in this abstraction, like those of *abstractio totius*, will not be separable from concrete individuals in the order of being. The difference between the first and second degree of abstraction is that rather than focusing on the essence or nature of an object, the intellect focuses on one of its accidental features. The aspect brought into consideration in this case are an object's *quantifiable*, or measurable, features. All concrete individuals have quantifiable features by virtue of the fact that all such

objects are extended in the three spatial dimensions. These accidents of quantity are abstracted from the other accidents of the object found in the remaining eight categories of being (its relationships to other objects, its location in space and time, its colour, whether it is hot or cold, soft or hard, acting or being acted upon, etc.) Aristotle makes these points in Book XIII of the *Metaphysics*:

For just as the universal propositions of mathematics deal not with objects that exist separately, apart from extended magnitudes and from numbers, but with magnitudes and numbers, not however *qua* such as to have magnitude or to be divisible, clearly it is possible that there should also be propositions and demonstrations about sensible magnitudes, not however, *qua* sensible but *qua* possessed of certain definite qualities. . . . there will be propositions and sciences, which treat [sensible magnitudes] however not *qua* mobile but only *qua* bodies, or again *qua* planes, or only *qua* lines, or *qua* divisibles, or *qua* indivisibles having position, or only *qua* indivisibles.<sup>26</sup>

The intelligible objects disengaged in this type of abstraction are known as 'sensible magnitudes', or the 'mathematicals', and consist of points, lines, plains, figures, numbers, and the like. The technical term for this species of abstraction is *abstractio formae*, for in this operation an accidental form is abstracted from the individual.

Now these intelligible objects are further removed from matter than are those of the natural sciences. For such objects do not depend on sensible matter, either individual or common, for their being understood. Unlike the objects of the natural sciences which require some reference to common sensible matter because these objects are essentially material entities, points, lines, figures, etc., can all be defined without reference to sensible matter. For example, the definition of triangle makes no reference to what material an actual triangle happens to be instantiated in, for a triangle is a triangle regardless of whether it is instantiated in wood or bronze. In fact no strictly sensible figure ever matches the figure as described in its formal definition. This is because the essential features of mathematical stem from their natures *as extended in space*. Yet Aristotle and Aquinas

insist that mathematical cannot exist apart from matter since they are nothing more than accidental features of concrete individuals abstracted by the intellect. So, while mathematical can be understood without reference to sensible matter, they cannot exist apart from matter.

Again, however, there is a complication. Although mathematical are abstracted entirely from sensible matter, they are not *separable* from matter. There remains, therefore, an important connection between mathematical and matter. The connection with matter is found in the very essence of mathematical, their measurable extension in space. This is appreciated most clearly when mathematical are contrasted with immaterial entities. Immaterial entities, the angels for example, are not spatially extended precisely because they are entirely immaterial. As matter is the principle of individuation, it is also the principle of extension. Some matter, therefore, is crucial to the nature of mathematical as the source or ground of their extension. Clearly this matter cannot be sensible matter since this would imply that matter like bronze or wood, flesh or bone, would have to be included in the definition of figures like triangle and circle. Although all actual figures will be instantiated in some sensible matter, this matter *qua* sensible is irrelevant to the nature of figure. To meet this difficulty Aristotle and Aquinas make use of a further distinction in the concept of matter. Aquinas says that mathematical are abstracted from sensible matter (both individual and common) and from *individual intelligible* matter, but not from *common intelligible* matter. 'Intelligible' matter can be defined as that component of an object that remains after all accidental features (apart from those of quantity) have been set aside. After such an operation what remains is a three dimensional continuum in space. Intelligible matter, therefore, is identified as the source or ground of an object's extension in space. Aquinas throws some light on this distinction with a brief comparison of sensible and intelligible matter. He writes:

And by *sensible matter* is meant such things as bronze and wood, or any changeable matter, such as fire and water and all things of this sort; and singular sensible things are individuated by such matter. But by *intelligible matter* is

meant what exists in things which are sensible *but are not viewed as sensible*, as the objects of mathematics. For just as the form of man exists in such and such matter, which is an organic body, in a similar way the form of a circle or of a triangle exists in this matter, which is a continuum, whether surface or solid.<sup>27</sup>

The difference between the abstraction of the natural sciences and that of mathematics is clearly seen to be one of the point of view adopted by the intellect.<sup>28</sup> Mathematical exist in the same sensible bodies as the objects of the natural sciences: but the intellect notices them by considering sensible bodies not *qua* sensible, but rather *qua* extended continua in space. For this reason the matter of the mathematics is called 'intelligible' rather than sensible; not because the ground of their being is not a sensible body, but because the mathematics are discovered when the intellect abstracts from the sensible aspects of bodies.

The further distinction between Individual and Common intelligible matter simply mirrors that found within sensible matter. Each instantiation of a circle, for example, has its own individual intelligible matter. But the definition of circle does not depend on this particular parcel of intelligible matter, but intelligible matter in general: all circles are extended in space, but they need not be extended by any particular parcel of intelligible matter.

There remains a final distinction between the objects of mathematics and those of the natural sciences which follows from the foregoing. The intelligible objects of mathematics are not subject change as is the case with the objects of the natural sciences. This is clear from a comparison between a human being, for example, and a circle. Human beings, unlike circles and other figures, are subject to birth, growth and decay as an essential feature of their mode of existence. Consequently the definition of human being, although stable in itself, actually defines a nature subject to change. This mutability is accounted for in the Aristotelio-Thomistic framework by the fact that humans are essentially material bodies, matter being the cause of change in natural things. But circles and figures are not subject to such changes accept



accidentally insofar as the mutable bodies from which they are abstracted are subject to change and decay. Even though a wooden circle may pass out of existence (after being burned, let us say) the wooden circle has not changed *qua* circle, but *qua* wooden object. If circles and triangles were subject to change in the same sense as sensible bodies, common sensible matter would have to appear as a component of their definition. But this is not the case, as we have seen. Consequently Aristotle and Aquinas can say that the mathematical objects are essentially immutable objects. Such then are the objects of mathematics and the abstraction that produces them; they are said to rise above the conditions of unintelligibility by the second degree.

*The Problem concerning Metaphysics: Its proper object and mode of abstraction*

Our first two speculative sciences, natural science and mathematics, have posed no difficulties of interpretation. We have identified their proper intelligible objects and their proper mode of abstraction. Things are not so straightforward, however, in the case of metaphysics. It is generally agreed<sup>29</sup> that its proper object must be 'separable' from matter in both the order of the understanding and the order of being. It is this feature that distinguishes metaphysics from the other two sciences. Just what this object is, however, is a matter of some dispute. In some passages of the *Metaphysics* it appears that Aristotle is saying the proper object of this science is being *qua* being, or being-in-general; but other passages suggest that metaphysics is the study of a particular type of being. Indeed, the task of reconciling the contradictory texts of Books IV and VI of the *Metaphysics* has become something of 'an old chess-nut' in Aristotelian scholarship. Natorp struggled with it in 1887<sup>30</sup>; Jaeger tried his hand in 1923<sup>31</sup>; Patzig addressed the issue again in 1959, and his work was included in a volume of essays published in 1979<sup>32</sup>. And since Wyser's critical edition of Questions 5 and 6 of *De Trinitate* Thomists have been re-examining the matter for themselves.

Thomists have tended to approach and discuss this problem within the

context of interpreting the doctrine of the three degrees of abstraction, an approach not as popular among Aristotle scholars with no Thomist affiliations.<sup>33</sup> There is, however, good reason to think that this problem of metaphysics ought to be approached in the Thomist manner. The Thomist approach to the problem has the virtue of taking seriously Aristotle and Aquinas' insistence on the point that the object of a science is, in large part, determined by the attitude or perspective adopted by the agent intellect. There is no obvious reason why this approach should be abandoned in the case of metaphysics: it is consistent with Aristotelian texts, and with the principles successfully employed in the case of the natural sciences and mathematics. Moreover, by their own admission the approaches of non-Thomist Aristotle scholars have failed to do justice to the various passages of the *Metaphysics*. Yet Aquinas' treatment of Aristotle's metaphysics appears to offer a way of reconciling the apparently contradictory claims in Books IV and VI. There is, however, another over-riding consideration that compels us to adopt the Thomist approach to this problem. Although Aquinas bases himself on Aristotle, we are actually engaged in a study of Aquinas, for it is Aquinas' use of Aristotle that is of primary interest to us. It is the nature of the Thomist synthesis of Aristotle and Christian theology that I suggest is informative insofar as we are looking for guidance in our approach to the realist dispute in science. Consequently, in this matter of the proper object of metaphysics, our emphasis must be on Aquinas rather than Aristotle.

Before we begin our study of Aquinas' treatment of Aristotle's metaphysics we would do well to have the conflicting texts before us and state the problem arising from them. In the *Metaphysics*, Book IV, Ch. 1 we find the following statement:

There is a certain science which studies being as being and the attributes which necessarily belong to being. This science is not the same as any of the so-called particular sciences [natural science and mathematics]; for none of the other sciences attempt to study being as being in general, but cutting off some part of it they study the accidents of this part. This, for example, is what the mathematical sciences do.<sup>34</sup>

Aquinas comments on this passage as follows:

Now because a science should investigate not only its subject but also the proper accidents of its subject, he therefore says, first, that there is a science which studies being as being, as its subject, and studies also "the attributes which necessarily belong to being," i.e., its proper accidents. He says "as being" because the other sciences, which deal with particular beings, do indeed consider being (for all the subjects of the sciences are beings), yet they do not consider being as being, but as some particular kind of being, for example, numbers or line or fire or the like.<sup>35</sup>

In these passages both authors state quite unequivocally that metaphysics is distinguished from the other sciences by the fact that it does not study any particular type of being, as do the natural sciences and mathematics, but rather being in general and its proper accidents. This view is sharply at odds with passages in the *Metaphysics*, Book VI, Ch 1. There we read that metaphysics is distinguished from the other sciences not by studying being in general, but by having its own particular area of being to study:

For the philosophy of nature deals with things which are inseparable from matter but not immobile. And some mathematical sciences deal with things which are immobile, but presumably do exist separately, but are present as it were in matter. First philosophy, however, deals with things which are both separate from matter and immobile.<sup>36</sup>

Aquinas echoes this sentiment as well:

But the first science deals with things which are separable from matter in being and altogether immobile.<sup>37</sup>

Consequently we are left with an apparent contradiction. On the one hand we have metaphysics characterised as the study of the general attributes of being *qua* being; on the other, we have metaphysics characterised as the study of a particular sort of being, the eternal separate substances (God and the Angels). Some<sup>38</sup> have gone so far as to suggest that there are in fact two sciences of metaphysics - metaphysics *generalis* and metaphysics *specialis* - and to wonder if the

science can ever be unified. With the problem clearly before us we can now move on to consider how Aquinas approaches it from within the discussion of the operation of abstraction.

In the case of the first two speculative sciences we noted that their modes of abstraction were confined to, or associated with, the first act of the intellect. The upshot of this classification is the agreement that while their intelligible objects cannot exist apart from matter, they can be abstracted from it in various degrees in the order of the understanding. The next degree of abstraction possible then would seem to produce an object that can be totally abstracted from sensible and intelligible matter in the order of the understanding *and* in the order of existence. Such an abstraction is assigned to the second act of the intellect, and in particular to negative judgements where predicates are *separated* from subject terms in the order of being and not just in the order of understanding. It is this added feature of separation that has led to the difficulties concerning the proper object of metaphysics and how it is obtained.

Aquinas makes it very clear in q. 5, a.3 of the *De Trinitate* that the mode of abstraction peculiar to metaphysics ought properly to be called a 'separation' rather than a third degree of abstraction.<sup>39</sup> Aquinas' insistence on this fact has brought into question the correctness of the traditional doctrine of the three degrees of abstraction taught by Cajetan and John of Saint Thomas. Some have thought it proper to reject the teaching of these two acknowledged masters<sup>40</sup>; others have sought to show that while there is a difference in terminology between their teaching and the third article of the fifth question, there is no significant disagreement in doctrine.<sup>41</sup> It is not our concern here to enter into the correctness or otherwise of Cajetan and John's teaching. What concerns us is the nature of the disengagement and the corresponding object, not the terminology used to convey these ideas. Nonetheless, Aquinas's insistence on the term 'separation' as opposed to 'abstraction' suggests that the objects of metaphysics actually exist apart from matter in the order of existence as well as the order of the understanding. And such an interpretation fits well with the fact that Thomist ontology does include immaterial separate substances, i.e. God

and the Angels. Consequently, upon a cursory inspection of q. 5, a.3 the reader can be forgiven for thinking that the objects of this third speculative science are the immaterial separate substances. Indeed many continue to hold this view after considerable study of the matter<sup>42</sup>, and they have been able to point to texts in both Aristotle and Aquinas to support this reading. The most significant perhaps, besides the passage quoted above, is Aristotle's comment in the *Metaphysics*, Book VI, Ch 1:

Therefore, if there is no substance other than those which exist in the way that natural substances do, the philosophy of nature will be the first science; but if there is an immobile substance, this philosophy will be prior, and the science which investigates it will be first philosophy, and will be universal in this way.<sup>43</sup>

Since it is clear that Aristotle and Aquinas agree that there is in fact at least one such substance, this passage has been taken as proof that metaphysics studies a particular type of being and not being in general. No one disputes the fact that for Aristotle and Aquinas metaphysics is the first of the speculative sciences; but it is first, on the authority of this text, because there is an immobile substance which is its particular object of study. If such a being did not exist metaphysics would not be the first science, a status it clearly holds; moreover, without this entity for metaphysics to study it is not clear that there would be a need for a separate science of metaphysics at all.

However, despite the fact that there is some textual basis for this view, it faces a number of serious difficulties which render it unacceptable as it stands. The first difficulty is perhaps the most serious. Aquinas says quite explicitly that God and the Angels are not objects arrived at by any form of abstraction or separation.<sup>44</sup> In fact it is a crucial feature of Thomist theology that knowledge of the separate substances is obtained in a qualified sense through completely different means.<sup>45</sup> Moreover, it is perfectly clear why God and the Angels could not be achieved through abstraction or separation. Abstraction in all its forms is performed in either the first or second act of the intellect. But neither God nor the Angels is ever subject to simple apprehension. Being immaterial they

are by nature not given in sensation. Consequently, they cannot be abstracted in the first act of the intellect. But this immediately rules out the possibility that they are abstracted in the second act since the second and third acts of the intellect depend on the completion of the first. Aquinas drives this point home when he says that

In the state of the present life, in which the soul is united to a corruptible body, it is impossible for our intellect to understand anything actually, except by turning to phantasms.<sup>46</sup>

Consequently, in order to maintain that God and the Angels are the proper object of metaphysics, one would be forced to claim either that the divisions of the sciences are not based on the operations of abstraction or separation, which is denied by those holding this view, or that Aristotle and Aquinas have completely violated the principles of empiricism to which they are firmly committed, or that metaphysics is not in fact a speculative science. I would submit that there is no compelling reason to think any of these claims is credible.

Second, this interpretation of the proper object of metaphysics fails to make sense of the passages in Book IV of the *Metaphysics*. As we saw, Aristotle and Aquinas also state that metaphysics studies the most general features of being *qua* being, and not just a particular area of being, as is the case with physics and mathematics. This interpretation simply ignores the problem we are dealing with by not discussing the conflicting passages.<sup>47</sup>

Finally, we can point to two significant and complementary passages in Aquinas which clearly imply that the proper object of metaphysics is not God or the Angels. The first is Aquinas' Preface to his commentary on Aristotle's *Metaphysics*, the second is Question 5, Article 4 of the *De Trinitate*. Both passages will be examined in detail in the next section. Suffice it to say for the moment that in the preface to the commentary on the *Metaphysics* Aquinas describes a tripartite division of the science of metaphysics into *first philosophy*, *metaphysics proper*, and *theology*, each of which is said to provide a distinct approach to the central topic of being *qua* being. As will become clear in the next section, this

passage makes it plain that God and the Angels are at the very least *not the only objects* of the science of metaphysics. But when read in conjunction with the fourth article of the fifth question of the *De Trinitate*, we will see that even this weakened thesis is not entirely appropriate. In this article Aquinas makes a clear distinction between how philosophers and theologians approach the study of metaphysics, a distinction which corresponds to the last two divisions of the science of metaphysics made in the Preface. This passage makes it plain that insofar as metaphysics is done by philosophers its proper object is being *qua* being and not God or the Angels.

But if we are satisfied that the proper object of metaphysics cannot be God or the Angels, we are still no closer to answering our original question. We still need to find the proper object and corresponding mode of abstraction of metaphysics. Only once this is done will we be able to unify the science and clearly distinguish it from the others. But far from finding the unity of metaphysics, we now are faced with the prospect of metaphysics being divided into the three components of first philosophy, metaphysics proper, and theology. Things appear to have taken a turn for the worse. However, a close reading of Aquinas will reveal a) that there is no real difficulty in uniting the three branches of metaphysics, and b) that we can find the distinct act of the intellect by which the proper object of metaphysics is obtained while doing justice to the various apparently contradictory passages. It is also my contention that Aquinas' solution to this problem is vital for a proper understanding of how his philosophy of science can aid us in our realist dispute in science.

### *The Unity and Diversity of Metaphysics*

The way out of our present difficulties is to consider the Preface to Aquinas' commentary on Aristotle's *Metaphysics*. This short passage in conjunction with q. 5, a.4 of *De Trinitate* provide the shape of a solution. The crux of the Preface is the thesis that metaphysics as a science can be divided into three components, each of which approaches the central subject being *qua* being in a different manner. That being *qua* being, or

being in general, is the central subject of metaphysics is made clear in the following passage:

Furthermore, it is evident from what has been said that although this science is concerned with the three objects mentioned, nevertheless it does not concern just any one of them as its subject, *but only being-in-general*.<sup>48</sup>

However, Aquinas does recognise that there is an apparent diversity of intelligible objects in this one science; nevertheless being-in-general is the true subject of metaphysics. What needs to be clarified is how this subject can be treated in various ways.

Aquinas opens his Preface by stating that the highest science must concern itself with 'the most intelligible beings'. What 'the most intelligible beings' actually are, of course, has yet to be determined; he is merely stipulating here what these objects must be like if they are to serve as the objects of the highest science. Now as we have progressed from the natural sciences to mathematics we have travelled further and further away from the particularising conditions of matter. So we can safely assume that the most intelligible beings will be those at the furthest remove from these conditions. If this were not the case there would be room for a fourth speculative science above metaphysics itself.

But at this point Aquinas employs a tactic not found in his treatment of either the natural sciences or mathematics. He says that 'the most intelligible beings', whatever they are, can receive this title according to three distinct criteria or points of view. An object can be 'the most intelligible', a) by virtue of the fact that it is that from which the intellect derives its certainty; b) on account of its degree of universality; and c), the criterion we are most familiar with, because of its distance from the particularising conditions of matter. The point to emphasise is that these distinct criteria of intelligibility each provide a distinct perspective from which to consider 'the most intelligible beings'. Aquinas then considers each criterion in turn and assigns a proper object to each.

Thus when considering 'the most intelligible beings' from the point of view of their power to produce certainty in the intellect Aquinas has this



to say:

Clearly, that from which the intellect derives its certainty seems to be the more intelligible beings. Consequently, since the intellect acquires certitude in science from causes, the knowledge of causes seems to be intellectual in the highest degree. It also follows that the science treating of first causes seems to be the supreme ruler of the others.<sup>49</sup>

Consequently, when 'the most intelligible beings' are considered in this light metaphysics is called *First Philosophy*, and its proper object is the primary cause or cause of all things.

But when the intellect considers 'the most intelligible beings' from the point of view of universality the focus of metaphysics changes accordingly. Aquinas write:

Second, 'the most intelligible beings' can be understood by comparing the intellect with the senses. Sense knowledge is of the particular, whereas the intellect seems to differ from the senses in that it comprehends universals. That science, then, is supremely intellectual that treats of the most universal principles. These are being and the properties that accompany being, such as one and many, potency and act.<sup>50</sup>

Here we find metaphysics characterised as the study of being *qua* being and its attendant properties.

Finally, one can approach the most intelligible beings insofar as they are at the furthest remove from matter:

Because a being has the power of intellect owing to its freedom from matter, those things must be supremely intelligible that are most disengaged from matter. . . . Now those things are most separated from matter that abstract not only from individual matter (such as natural forms understood universally, which are the objects of natural science), but entirely from sensible matter; and these are separated from matter not only in thought, like the mathematical, but also in existence, such as God and the Intelligences. Consequently, the science inquiring into these beings seems to be most intellectual and the director or mistress of the rest.<sup>51</sup>

Here we have metaphysics characterised as the study of God and the Angels. So far it would seem that Aquinas has not helped his cause in the least. Rather than finding the proper object of metaphysics he seems to have found a proper object for three new sciences. And rather than sticking to his preferred method of division, i.e., degrees of abstraction, he has introduced two new criteria. However, these difficulties can be met by showing a) that all three criteria in fact produce three distinct perspectives on one and the same intelligible object, and b), that the criterion of abstraction provides the true subject of this tripartite science which is being *qua* being.

With these distinct approaches to the most intelligible objects in place, Aquinas proceeds to show how they can all be considered as presenting different lights on the same thing, and consequently as different aspects of the same science. He writes:

Now this threefold consideration is not to be attributed to different sciences but to one. For the above-mentioned separated substances (God and the Intelligences) are the universal and primary causes of being. What is more, it belongs to the same science to investigate the proper causes of any genus and the genus itself. . . . So it must belong to the same science to investigate the separate substances and being-in-general (*ens commune*), which is the genus of which the above-mentioned substances are the common and universal causes.<sup>52</sup>

In other words, the proper object of metaphysics is being-in-general and its attendant properties. But insofar as complete knowledge of an object depends in part on knowledge of its causes, metaphysics must also consider the separate substances in some way. In first philosophy it considers them as the causes of the beings given in sensation; in theology, they are considered as beings in themselves. Aquinas then sums up his preface with the following lines:

This science, then, is given three names corresponding to the three objects mentioned above, from which its perfection is derived. It is called *divine science* or *theology* inasmuch as it treats of the substances referred to above. It is called

*metaphysics* because it considers being and its attendant properties. . . . And it is called *first philosophy* inasmuch as it considers the first causes of things.<sup>53</sup>

With metaphysics unified in this way we need to consider the following questions. First, how is the proper object of metaphysics, being in general, connected with the intellectual operation of abstraction? And second, what is the epistemological significance of the fact that being-in-general is gained through abstraction while the separate substances as treated in either first philosophy or theology are not? Let us take these in turn.

It is clear that of the three objects of metaphysics only being-in-general can be gained through a process of abstraction. The objects of first philosophy and theology can be ruled out for the following reasons. The intellect comes to study the first causes, or unmoved mover, as a natural continuation of the study of motion in physics. But the first causes are not abstracted from concrete individuals because these causes are not sensible. In Book VIII of the *Physics* Aristotle is led to posit an unmoved first cause as a means of explaining the processes of mobile bodies noticed in physics. This process is hardly similar to the process of abstraction we have been investigating; in fact we can characterise this process as an example of the type of thinking found in the third act of the intellect, namely, reasoning from premises to a conclusion. And as we have seen, all forms of abstraction occur in either the first or second act of the intellect. It is also clear that God and the angels are not reached by abstractions in acts one or two because, as noted above, such acts begin in sensation, and God and the angels are not sensible entities. Consequently no process of abstraction is involved in the obtaining of the objects of either first philosophy or theology. This result suits us very well, for the separate substances are the cause of our object of study, not the object of study itself. It is fitting, therefore, that they not be obtained through abstraction, for it is by a process of abstraction that the proper object of each science is obtained. It remains to determine what kind of abstraction one might attribute to that branch of metaphysics which studies being in general. And we are encouraged to search for such an abstraction because

Aquinas says that the objects of this branch of metaphysics are 'discovered by the process of *analysis* as the more universal is discovered after the less universal', a process reminiscent of the abstractions of natural science and mathematics.

The abstraction peculiar to this branch of metaphysics is not to be found in the works of Aristotle. In fact the distinction that Aquinas employs to divide metaphysics from the other speculative sciences is his particular contribution to the history of metaphysics.<sup>54</sup> This particular mode of abstraction occurs in the second act whereby the intellect *separates* the essence of  $x$  from its act of existence, or more precisely, its act of existence from its essence. The nature of this distinction is clearer when contrasted with the abstractions of natural philosophy and mathematics. As said above, the abstractions of natural science and mathematics occur in the first act of the intellect following simple apprehension. The act of simple apprehension is that act whereby the intellect grasps the nature of  $x$ . Now if we had to look for a proposition the intellect could assent to following simple apprehension of  $x$ , such a proposition would be, ' $x$  is of such and such a kind or nature'. In this act the intellect's attention is focused entirely on the nature or essence of  $x$ , and this focus is manifested in the two abstractions that occur in this particular act. In the first degree of abstraction the intellect disengages the nature of this essence from the particular instantiations of it (the *abstractio totius* of natural philosophy). In the second degree of abstraction the intellect disengages an accident of this nature, its being as subject to quantity (the *abstractio formae* of mathematics). Now what distinguishes metaphysics from the first two speculative sciences is that here the intellect focuses not on the essence of  $x$ , or an accident thereof, but on  $x$ 's act of existence, on the fact that it exists. And its fundamental point of departure is not the affirmative judgement, ' $x$  is such and so', but rather the negative judgement, 'the essence of  $x$  is *not* its existence'. (Another way to phrase this statement is to say that existence is not part of the essence or definition of  $x$ . Only a self-subsistent or self-causing being would have existence included in its definition, for by definition it would be part of its nature that it exist.<sup>55</sup> But since every concrete individual encountered in the world of experience is subject to change, including generation and corruption,

no concrete individual can be said to possess its own act of being, and hence existence cannot be included in its definition.) So when the intellect focuses on an object with the perspective peculiar to metaphysics it must:

depasser l'ordre des essences materielles, object connaturel de la simple appréhension, et se faire attentive à ce qui dans les sujets corporels offert à ses prises est l'acte des actes et la perfection des perfections, l'acte d'exister.<sup>56</sup>

This operation produces another intelligible object, viz., being-in-general, and those properties of an individual that it has in virtue of the fact that it exists. These properties are called the Transcendentals. They include being, substance, accident, actuality, potentiality, truth, goodness, unity, and form the subject matter of metaphysics.

But if the Transcendentals are gained through abstraction in this way we are left with an obvious question. In what sense can the Transcendentals be said to be strictly separable? Surely we cannot have an act of existence and its attendant properties without there being some essence to exist as the subject of this act. In other words, one may be able to abstract *x*'s act of existence from its essence in the order of the understanding, but we are surely not going to find it separated from its essence in the order of being. This would amount to saying that there could be action and activity without an actor, a verb without a subject. Now it is clear that the separate substances are 'separated' in a strict sense, they exist apart from matter in the order of being; but we have already seen that these cannot be gained through any process similar to abstraction. So we must ask why Aquinas insists on calling this third intellectual operation a 'separation' rather than a third degree of abstraction.<sup>57</sup> The answer to this question lies in distinguishing between a strong and a weak sense of separation, and on the insistence that the Transcendentals are not entities but predicables (aspects of entities).

As we have said, the proper object of metaphysics is being-in-general. Now it is for precisely this reason that to achieve this object the intellect must abstract entirely, in some sense, from concrete individuals.

Because metaphysics studies being-in-general, it cannot restrict itself to studying material individuals alone for the simple reason that the world may contain entities that are not material. In fact, as we have seen, the studies of motion in physics have led Aristotle and Aquinas to posit the existence of at least one such entity. In order to maintain its generality, then, metaphysics must find intelligible objects that are true of *any* existing entity, material or otherwise. Now this is precisely the defining feature of the Transcendentals: they are true of any entity whatsoever simply because they accompany any *x* in virtue of the fact that it exists. The angels, for example, insofar as they exist, are one, good, subject to the distinction between potency and actuality, etc., as are all concrete material individuals. So we can say that the Transcendentals are 'separable' in this weak sense: although the Transcendentals are discovered by analysis of material individuals, nonetheless they can be predicated without error of non-material entities (should they exist). In effect, the intellect has found some aspect of the material world that can be 'separated' from it and applied to the immaterial realm as well. This is possible because the Transcendentals are not entities in their own right, but aspects of all entities insofar as they exist.<sup>58</sup>

Now the weak sense in which the Transcendentals are separable is contrasted with the strong sense in which God and the angels are separate from matter. God and the angels cannot exist in matter in any sense whatsoever because, unlike the Transcendentals which are predicables, they are entities in their own right, and immaterial at that. Aquinas is getting at this distinction when he summarises in a dense passage the distinction between God and the angels, the Transcendentals and the mathematical:

Something can exist separate from matter and motion in two distinct ways: First, because by its nature the thing that is called separate in no way can exist in matter and motion, as God and the angels are said to be separate from matter and motion. Second, because by its nature it does not exist in matter and motion; but it can exist without them, though we sometimes find it with them. In this way being, substance, potency, and act are separate from matter and motion, because they do not depend on them for their existence, unlike the objects of mathematics, which can only exist in

matter, though they can be understood without sensible matter.<sup>59</sup>

So we can say with Aquinas that God and the angels are strongly separated from matter; the Transcendentals are weakly separated from matter (abstracted in the second act of the intellect); the mathematical are not separable at all, but abstracted in the first act of the intellect (from sensible and individual intelligible matter); and the objects of natural science are also abstracted in the first act but to a lower degree (from individual sensible matter).

Despite the fact that the Transcendentals are only weakly separable, they are nonetheless separable in a sense that the intelligible objects of natural science and mathematics are not. The abstractions of natural science and mathematics produce intelligible objects that express the essence of material individuals, or those features they have by virtue of being extended in space. Consequently it cannot be said that these objects could in any way be seen to apply to immaterial substances; yet those aspects of material entities they have in virtue of existing, their Transcendental features, do apply to immaterial substances. So there is a sense in which the objects of metaphysics are 'separable', and hence distinct from the objects of natural science and mathematics. In Thomist terminology this distinction is expressed in terms of dependent existence, rather than predication. As we have seen, Aquinas says the objects of natural science and mathematics cannot exist without matter, whereas those of metaphysics can, this distinction being signalled by saying the objects of the first two sciences are 'abstracted' while those of metaphysics are 'separated'. But there is no conflict here, simply a difference in expression. For we can say with Aquinas that if there were no material individuals, the objects of natural science and mathematics would also cease to exist; on the other hand the objects of metaphysics, the Transcendentals, could still exist as aspects of immaterial entities should they continue to exist. Nevertheless I prefer to refer to this third operation of the intellect as 'abstraction in the second act of the intellect', as opposed to 'the third degree of abstraction' or the 'first separation'. To speak of 'three degrees of abstraction' can mask or obscure the fact that the abstraction of

metaphysics is significantly different from that of the natural sciences or mathematics. To speak of 'separation', however, gives the misleading impression that the operation of the intellect in metaphysics is quite unlike those of natural science and mathematics. It also gives the erroneous impression that the proper object of metaphysics is God and the Angels. To speak of two abstractions in the first act of the intellect and one abstraction in the second does justice to the points Aquinas wishes to make without being misleading.

We can now turn to the second of our questions: why is it significant that the proper object of metaphysics is gained via abstraction in the second act of the intellect while the objects of first philosophy and theology are not? The simple answer is because of the Aristotelian-Thomist commitment to empiricism. If metaphysics is to be a speculative science it must be grounded in data received in sensation. Because the objects of first philosophy and theology are not the products of abstraction, they are not grounded in sensation in the sense attributable to the Transcendentals - for the Transcendentals are discovered by analysis of objects given in sensation. Consequently, the branches of first philosophy and theology are qualitatively different from the study of Transcendentals. This qualitative distinction is clearly recognised by Aquinas, and he marks this difference by separating the approach of the philosopher from that of the theologian in the study of metaphysics. It can be said that the philosopher studies those intelligible objects that are weakly separable, i.e., the proper object of metaphysics, viz., being in general and its attendant properties. And since the philosopher posits a separate substance as a necessary hypothesis of his physical studies, it can be said that he studies the separate substances *qua* cause or principle of the proper object of metaphysics, the act of existence of the entities given in sensation. But only the theologian studies the separate substances as beings in their own right. Aquinas makes this perfectly clear in the following terms:

. . . because these divine beings [the separate substances] are the principles of all things and are complete natures in themselves, they can be studied in two ways: first, insofar as they are the common principles of all things, and second, insofar as they are beings in their own right. But even though



these first principles are most evident in themselves, our intellect regards them as the eye of an owl does the light of the sun, as the *Metaphysics* says. We can reach them by the light of natural reason only to the extent that their effects reveal them to us. . . . *Philosophers, then, study these divine beings only insofar as they are the principles of all things. Consequently, they are the objects of the science that investigates what is common to all beings, which has for its subject being as being.* 60

In other words, the philosopher is confined to the study the empirically observable effects of the separate substances. This is in keeping with the commitment to empiricism. Aquinas then states how the theologians approach the separate substances:

There is, however, another way of knowing beings of this kind, not as their effects reveal them, but as they reveal themselves. The Apostle mentions this way in his *First Epistle to the Corinthians*: "So the things also that are of God no man knoweth, but the Spirit of God. Now we have received not the spirit of this world, but the Spirit that is of God, that we may understand."61

There is no mistaking this approach as that of the philosopher. And to underline this fact Aquinas makes it explicit:

Accordingly, there are two kinds of theology. There is one that treats of divine things, not as the subject of the science but as the principles of the subject. This is the kind of theology pursued by the philosophers and that is also called metaphysics. There is another theology, however, that investigates divine things for their own sakes as the subject of the science. This is the theology taught in Sacred Scripture.62

This is the reason for the importance of tying the objects of metaphysics to the intellectual operation of abstraction. Were the intellect not able to disengage being-in-general and the Transcendentals from material objects given in sensation, metaphysics could not be a science. As it is, the speculative sciences must confine themselves to studying the effects of the separate substances, the material entities given in sensation. Any study of the separate substances themselves and any knowledge

gained in such efforts must be qualitatively different from those of the speculative sciences.

Our conclusion then is that metaphysics is in fact one science in the sense that it has a single proper object, being in general and its attendant properties. So we have finally identified the three speculative sciences, their proper abstraction, their corresponding proper intelligible objects, and shown how all can be derived from the initial sensory data of material entities. But given that knowledge of the proper object of any science depends in part upon knowledge of its causes, the metaphysician will naturally be interested in the cause of being-in-general. But the fact that the cause of being-in-general for both Aristotle and Aquinas is an immaterial entity introduces an epistemological rupture within this single science. In this sense the branches of metaphysics are qualitatively different from an epistemological point of view. The consequences of this rupture will be the subject of the next chapter.

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<sup>1</sup> Etienne Gilson, *Le Thomisme*. Sixième Edition. Paris: Librairie Philosophique J. Vrin, 1986, p.292.

<sup>2</sup> Kirk, Raven and Schofield, *The Presocratic Philosophers*. Second Edition. Cambridge: Cambridge University Press, 1991, p.75.

<sup>3</sup> Aristotle writes: 'Of things that exist, some exist by nature, some from other causes. 'By nature', the animals and their parts exist, and the plants and the simple bodies (earth, fire, air water) - for we say that these and the like exist 'by nature'. All the things mentioned present a feature in which they differ from things which are not constituted by nature. Each of them has *within itself* a principle of motion and of stationariness. . . . On the other hand, a bed and a coat and anything else of that sort, *qua* receiving these designations - i.e., in so far as they are products of art - have no innate impulse to change. . . - which seems to indicate that *nature is a source or cause of being moved and of being at rest in that to which it belongs primarily.*' *Physics*, Book II, Ch 1. *The Basic Works of Aristotle*. Ed. Richard McKeon. New York: Random House, 1941.

<sup>4</sup> "Nor can we reasonably say, Cratylus, that there is knowledge at all, if everything is in a state of transition and there is nothing abiding." Plato, *Cratylus*, 440a-b. In *The Collected Dialogues of Plato*. Ed. Hamilton and Cairns. Princeton: Princeton University Press, 1961.

<sup>5</sup> Kirk, Raven and Schofield, p.187.

<sup>6</sup> See Aristotle's *Metaphysics*, Book I Ch. 6, 987a 32-34. Here we read that Plato in his youth, 'first became familiar with Cratylus and with the Heraclitean doctrines (that all sensible things are ever in a state of flux and there is no knowledge about them).' In *The Basic Works of Aristotle*. Ed. McKeon. Aquinas accepts this position as well in q. 84, a.1 of the *Summa Theologiae*.

<sup>7</sup> Kirk, Raven and Schofield, p.251.

<sup>8</sup> The following is a list of the more influential papers on this matter. L.B. Geiger's 'Abstraction et separation d'après S. Thomas' in *The Thomist*, vol. 22, 1959, p.3-40; J.D. Robert's 'La Metaphysique, science distincte de toute autre discipline philosophique, selon saint Thomas d'Aquin' in *Divus Thomas*, vol. 50, 1947, p.206-222; M.V. Leroy's 'Le Savoir Speculative', in *Revue Thomist*, vol. 21, 1948, p. 328-339; M.D. Philippe's 'Abstraction, addition, separation dans la philosophie d'Aristote' in *Revue Thomist*, vol.21, 1948, p.461-479; F.G. Connolly's 'Science vs Philosophy', in *The Modern Schoolman*, vol. XXIX, 1952, p.197-209, and 'Abstraction and Moderate Realism', in *The New Scholasticism*, vol. XXVII, 1953, p.72-90; V. Simth's 'Abstraction and the Empiriological Method', in *Proceedings of the American Catholic Philosophical Association*, vol. XXVI, p.35-50; P. Merlan's 'Abstraction and Metaphysics in St. Thomas' Summa', in the *Journal of the History of Ideas*, vol. XIV, 1953, p.284-291; G. Van Riet's 'La théorie de l'abstraction', in *Revue Philosophique de Louvain*, vol. L, 1952, p.353-393; W. Kane's 'Abstraction and the Distinction of the Sciences', in *The Thomist*, vol. 17, 1954, p.43-68; F. Cunningham's 'A Theory on Abstraction in St. Thomas', in *The Modern Schoolman*, vol. XXXV, 1958, p.249-270; and E.D. Simmons's 'In Defence of Total and Formal Abstraction', in *The New Scholasticism*, vol.XXIX, 1955, p. 427-440, and 'The Thomistic Doctrine of the Three Degree of Formal Abstraction', in *The Thomist*, vol. 22, 1959, p.37-67.

<sup>9</sup> (Ad cuius causae evidentiam) considerandum est quod multa sunt coniuncta secundum rem, quorum unum non est de intellectu alterius: sicut album et musicum coniunguntur in aliquo subiecto, et ideo potest unum separatim intelligi sine alio. Et hoc est unum intellectum esse abstractum ab alio. In *Octo Libros Physicorum Aristotelis Expositio*, L. II, l. iii (161). Romae: Marietti, 1954. Translation by Blackwell, Spath and Thirkel in *Commentary on Aristotle's Physics*. London: Routledge & Kegan Paul.

<sup>10</sup> Si vero consideremus colorem et proprietates eius, nihil considerantes de pomo colorato; vel quod sic intelligimus, etiam voce exprimamus; erit absque falsitate opinionis et orationis. Pomum enim non est de ratione coloris; et ideo nihil prohibet colorem intelligi, nihil intelligendo de pomo. *Summa Theologiae*, Prima Pars, q.85, a. 1 ad 1. Rome: Marietti, 1952. English translation in *Introduction to St. Thomas Aquinas*, Ed. Anton Pegis. New York: The Modern Library, 1948.

<sup>11</sup> "Therefore our intellect knows itself, not by its essence, but by means of its activity. And this in two senses. First, speaking particularly, as when Socrates or Plato perceives himself to have an intellectual soul from the fact that he perceives himself to be intellectually acting. Second, speaking universally, as when we consider the nature of the human mind from the nature of the intellect's activity." Non ergo per essentiam suam, sed per actum suum se cognoscit intellectus noster. Et hoc dupliciter. Uno quidem modo, particulariter, secundum quod Socrates vel Plato percipit se habere animam intellectivam, ex hoc quod percipit se intelligere. Alio modo, in universali, secundum quod naturam humanae mentis ex actu intellectus consideramus. *Summa Theologiae*, q. 87, a.1. Blackfriars.

<sup>12</sup> *Summa Theologiae*, q. 79, a.4. In Pegis. It is important to recognise that 'action' does not refer here to any effect whatsoever, produced by the soul, but only those that are called its proper activities. See Stephen Makin's article 'Aquinas, natural Tendencies and Natural Kinds' in *The New Scholasticism*, 1989, p.253-274, for a discussion of this point. He begins from Aquinas' methodological assumption that, 'What is a thing of a certain kind is what performs the operations of that kind of thing.'

<sup>13</sup> See G. Van Riet's, 'La théorie thomiste de l'abstraction', p.353. This is also clear from the argumentation provided in q. 85, a. 2 of the *Summa* where certain arguments are rejected solely on the grounds that the principle assumption would be violated under these circumstances.

<sup>14</sup> The details of this process need not concern us here. The process is described in

some detail in Aristotle's *Posterior Analytics*, Book II, Ch. 19; and in Aquinas' commentary thereon in *In Posteriorum Analyticorum* L. II, l. lxx.

<sup>15</sup> Charles De Koninck. 'Abstraction from Matter', Part One, in *Laval Théologique et Philosophique*, vol. 13, p.163.

<sup>16</sup> See Aquinas' Prooemium to *In Libros Peri Hermeneias*. Romae: Marietti, 1955.

<sup>17</sup> Et ideo ad intelligendum non sufficeret immaterialitas intellectus possibilis, nisi adesset intellectus agens, qui faceret intelligibilia in actu per modum abstractionis. *Summa Theologiae*, q. 79, a. 3, ad 3.

<sup>18</sup> De Koninck, p.163.

<sup>19</sup> *De Ente et Essentia*, caput II (6).

<sup>20</sup> Et ideo proprium eius est cognoscere formam in materia quidem corporali individualiter existentem, non tamen prout est in tali materia. Cognoscere vero id quod est in materia individuali, non prout est in tali materia, est abstrahere formam a materia individuali, quam repraesentant phantasmata. *Summa Theologiae*, q. 85, a. 1. Marietti.

<sup>21</sup> Unde et intellectus, qui abstrahit speciem non solum a materia, sed etiam a materialibus conditionibus individuantes, perfectius cognoscit quam sensus, qui accipit formam rei cognitae sine materia quidem, sed cum materialibus conditionibus. *Summa Theologiae*, q. 84, a. 2.

<sup>22</sup> Leroy, p. 279.

<sup>23</sup> Sciendum est igitur quod secundum Philosophum in III De anima duplex est operatio intellectus. Una, quae dicitur 'intelligentia indivisibilium', qua cognoscit de unoquoque, quid est. Alia vero, qua componit et dividit, scilicet enuntiationem affirmativam vel negativam formando. Et hae quidem duae operationes duobus, quae sunt in rebus, respondent. Prima quidem operatio respicit ipsam naturam rei, secundum quam res intellecta aliquem gradum in entibus obtinet, sive sit res completa, ut totum aliquod, sive res incompleta, ut pars vel accidens. Secunda vero operatio respicit ipsum esse rei, quod quidem resultat ex congregatione principiorum rei in compositis vel ipsam simplicem naturam rei concomitatur, ut in substantiis simplicibus. *Expositio Super Librum Boethii De Trinitate*, q. 5, a.3. Leiden: E.J. Brill, 1955.

<sup>24</sup> (Ergo dicendum quod) abstrahere contingit dupliciter. Uno modo, per modum compositionis et divisionis; sicut cum intelligimus aliquod non esse in alio, vel esse separatum ab eo. Alio modo, per modum simplicis et absolutae considerationis; sicut cum intelligimus unum, nihil considerando de alio. *Summa Theologiae*, q. 85, a. 1, ad. 1. Marietti.

<sup>25</sup> Et ideo sciendum est, quod materia non quomodolibet accepta est principium individuationis, sed solum materia signata. Et dico materiam signatam quae sub certis dimensionibus consideratur. Haec autem materia in definitione hominis, in quantum homo, non ponitur, sed poneretur in definitione Socratis, si Socrates definitionem haberet; in definitione autem hominis ponitur materia non signata; non enim in definitione hominis ponitur hoc os et haec caro, sed os et caro absolute, quae sunt materia hominis non signata. *De Ente et Essentia*, caput II, (6). Romae: Marietti, 1948.

<sup>26</sup> *Metaphysics*, Book XIII, Ch. 3, 1077b 17-23, 27-31, in *The Basic Works of Aristotle*.

<sup>27</sup> Sensibilis quidem ut aes et lignum, vel etiam quaelibet materia mobilis, ut ignis et aqua, et huiusmodi omnia; et a tali materia individuantur singularia sensibilia. Intelligibilis vero materia est, quae est in sensibilibus, non in quantum sunt sensibilia, sicut mathematica sunt. Sicut enim forma hominis est in tali materia, quae est corpus organicum, ita forma circuli vel trianguli est in hac materia quae est continuum vel superficies vel corpus. *In Duodecim Libros Metaphysicorum Aristotelis Expositio*, L. VII, l. x (1496). Romae: Marietti, 1950. English translation by John Rowan in *Commentary on the Metaphysics of Aristotle*. Chicago: Henry Regnery Company, 1961.

- 28 See Aristotle's *Physics*, Book II, Ch. 2. and Aquinas' commentary thereon in *In Octo Libros Physicorum Aristotelis Expositio*, L. II, l. III (160).
- 29 See the articles listed footnote no. 8 above.
- 30 P. Natorp. 'Thema und Disposition der aristotelischen Metaphysik', in *Philosophische Monatshefte*, vol. 24, 1887, p.37-65, 540-74.
- 31 W.W. Jaeger. *Aristotle*. English trans. by Robinson, 2nd ed. Oxford, 1948; first German ed. 1923.
- 32 G. Patzig. 'Theology and Ontology in Aristotle's *Metaphysics*', in *Articles on Aristotle*. Ed. by Barnes, Schofield and Sorabji, London: Duckworth, 1979.
- 33 This became apparent in a discussion with Richard McKirhan. He is willing to entertain answers to this question which may conflict with the role of abstraction as understood by Thomists.
- 34 Aristotle's *Metaphysics*, Book VI, Ch. 1 294-295. In *Commentary on the Metaphysics of Aristotle*, vol. II. English translation by John Rowan.
- 35 Quia vero scientia non solum debet speculari subiectum, sed etiam subiecto per se accidentia: ideo dicit primo quod est quaedam scientia, quae speculatur ens secundum quod ens, sicut subiectum, et speculatur 'ea quae insunt enti per se', idest entis per se accidentia. Dicit autem 'secundum quod est ens', quia scientiae aliae, quae sunt de entibus particularibus, considerant quidem de ente, cum omnia subiecta scientiarum sint entia, non tamen considerant ens secundum quod ens, sed secundum quod est huiusmodi ens, scilicet vel numerus, vel linea, vel ignis, aut aliquid huiusmodi. In *Metaphysicorum*, L. IV, l. I (529-530). English translation by P. Rowan, *Commentary on the Metaphysics of Aristotle*, vol. I.
- 36 *Metaphysics*, Book VI, Ch. 1. Trans by Rowan.
- 37 Sed prima scientia est circa separabilia secundum esse, et quae sunt omnino immobilia. In *Metaphysicorum*, L. VI, l. I (1163).
- 38 See Merlan, p.289-291.
- 39 Sic ergo in operatione intellectus triplex distinctio invenitur. Una secundum operationem intellectus componentis et dividens, *quae separatio dicitur proprie*: et haec competit scientiae divinae sive metaphysicae. Alia secundum operationem, qua formantur quidditates [sic] rerum, quae est abstractio formae a materia sensibili; et haec competit mathematicae. Tertia secundum eandem operationem 'quae est abstractio' universalis a particulari; et haec competit etiam physicae et est communis omnibus scientiis, quia in scientia praetermittitur quod per accidens est et accipitur quod per se est. *De Trinitate*, q. 5, a. 3. Leiden: E. J. Brill, 1955. My italics.
- 40 See Geiger, p.14.
- 41 Van Riet continues to speak of three degrees of abstraction, and Simmons vigorously defends the traditional line in both of his articles listed in footnote no. 8.
- 42 See Geiger, p.21-28; and Kane, p. 66-67.
- 43 In *Commentary on the Metaphysics of Aristotle*.
- 44 Unde secundum statum praesentis vitae, neque per intellectum possibilem, *neque per intellectum agentem*, possumus intelligere substantias immateriales secundum seipsas. *Summa Theologiae*, q. 88, a. 1. Quantumcumque intellectus noster abstrahat quidditatem rei materialis a materia, nunquam perveniet ad aliquid simile substantiae immateriali. *Summa Theologiae*, q. 88, a. 2. Merlan uses this to argue forcefully against the position of Geiger and Kane.
- 45 Dicendum quod incorporea, quorum non sunt phantasmata, cognoscuntur a nobis per comparisonem ad corpora sensibilia, quorum sunt phantasmata. Sicut veritatem intelligimus ex consideratione rei circa quam veritatem speculmur; Deum autem, ut Dionysius dicit, cognoscimus ut *causam*, et *per excessum*, et *per remotionem*; alias etiam incorporeas substantias, in statu praesentis vitae, cognoscere non possumus nisi per remotionem, vel aliquam comparisonem ad corporalia. *Summa Theologiae*, q. 84, a.7, ad. 3. These processes are put to use in q. 1 of the *Summa*, q. 1 and 2 of *De Trinitate*, and exemplified in *Treatise on Separate*

*Substances.*

<sup>46</sup> (Dicendum quod) impossibile est intellectum nostrum, secundum praesentis vitae statum, quo passibili corpori coniguitur, aliquid intelligere in actu, nisi convertendo se ad phantasmata. *Summa Theologiae*, q. 84, a.7.

<sup>47</sup> Kane in particular pursues his argument without even mentioning the fact that there are conflicting passages.

<sup>48</sup> The English translations of the following passages are all by Maurer in *The Division and Method of the Sciences*. Toronto: The Pontifical Institute of Medieval Studies, 1963. All Latin texts taken from the Preface to *In Metaphysicorum*, Marietti, 1950. Ex quo apparet, quod quamvis ista scientia praedicta tria consideret, non tamen considerat quodlibet eorum ut subiectum, sed ipsum solum ens commune.

<sup>49</sup> Unde, cum certitudo scientiae per intellectum acquiratur ex causis, causarum cognitio maxime intellectualis esse videtur. Unde et illa scientia, quae primas causas considerat, videtur esse maxime aliarum regulatrix. *Ibid.*

<sup>50</sup> Secundo ex comparatione intellectus ad sensum. Nam, cum sensus sit cognitio particularium, intellectus per hoc ab ipso differre videtur, quod universalia comprehendit. Unde et illa scientia est intellectualis, quae circa principia maxime universalia versatur. Quae quidem sunt ens et ea quae consequenter ens, ut unum et multa, potentia et actus. *Ibid.*

<sup>51</sup> Nam cum unaquaeque res ex hoc ipso vim intellectivam habeat, quod est a materia immunis, oportet illa esse maxime intelligibilia, quae sunt maxime a materia separata. . . .Ea vero sunt maxime a materia separata, quae non tantum a signata materia abstrahunt, 'sicut formae naturales in univerali acceptae, de quibus tractat scientia naturalis', sed omnino a materia sensibili. Et non solum secundum rationem, sicut mathematica, sed etiam secundum esse, sicut Deus et intelligentiae. Unde scientia, quae de istis rebus considerat, maxime videtur esse intellectualis, et aliarum princeps sive domina. *Ibid.*

<sup>52</sup> Haec autem triplex consideratio, non diversis, sed uni scientiae attribui debet. Nam praedictae substantiae separatae sunt universales et primae causae essendi. Eiusdem autem scientiae est considerare causas proprias alicuius generis et genus ipsum. . . .Unde oportet quod ad eandem scientiam pertineat considerare substantias separatas, et ens commune, quod est genus, cuius sunt praedictae substantiae communes et universales causae. *Ibid.*

<sup>53</sup> Secundum igitur tria praedicta, ex quibus perfectio huius scientiae attenditur, sortitur tria nomina. Dicitur enim scientia divina sive *theologia*, in quantum praedictas substantias considerat. *Metaphysica*, in quantum considerat ens et ea quae consequuntur ipsum. . . .Dicitur autem *prima philosophia*, in quantum primas rerum causas considerat. *Ibid.*

<sup>54</sup> Etienne Gilson, *God and Philosophy*. New Haven: Yale University Press, 1941, p.67.

<sup>55</sup> Omnis autem essentia vel quiddita intelligi potest sine hoc quod aliquid intelligatur de esse suo facto: possum enim intelligere quid est homo vel phoenix, et tamen ignorare an esse habeant in rerum natura. Ergo patet quod esse est aliud ab essentia vel quidditate: nisi forte sit aliqua res cuius quidditas sit suum esse. *De Ente et Essentia*, Caput V, (3). Marietti, 1948.

<sup>56</sup> Leroy, p. 284.

<sup>57</sup> It has been argued (Leroy) that Aquinas does not always stick to this terminological precision and that we ought not to take this insistence on separation too seriously. I think Leroy has a point. But it is clear that Aquinas uses 'separatio' in metaphysics to combat the Platonic errors in mathematics, and to signal a significant difference between the objects of metaphysics and those of the other sciences.

<sup>58</sup> Merlan is keen to point this out.

<sup>59</sup> Secundum quod dupliciter potest esse aliquid a materia et motu separatum secundum esse. Uno modo sic, quod de ratione ipsius rei, quae separata dicitur, sit

quod nullo modo in materia et motu esse possit, sicut deus et angeli dicuntur a materia et motu separati. Alio modo sic, quod non sit de ratione eius quod sit in materia et motu, sed possit esse sine materia et motu, quamvis quandoque inveniatur in materia et motu. Et sic ens et substantia et potentia et actus sunt separata a materia et motu, quia secundum esse a materia et motu non dependent, sicut mathematica dependebant, quae numquam nisi in materia esse possunt, quamvis sine materia sensibili possint intelligi. *De Trinitate*, q. 5 a. 4.

<sup>60</sup> Ergo res divinae, quia sunt principia omnium entium et sunt nihilominus in se naturae completae, dupliciter tractari possunt: uno modo, prout sunt principia communia omnium entium; alio modo, prout sunt in se res quaedam. Quia autem huiusmodi prima principia quamvis sint in se maxime nota, tamen intellectus noster se habet ad ea ut oculos noctuae ad lucem solis, ut dicitur in II *Metaphysicae*, per lumen naturalis rationis pervenire non possumus in ea nisi secundum quod per effectus in ea ducimur; . . . Unde et huiusmodi res divinae non tractantur a philosophis, nisi prout sunt rerum omnium principia. Et ideo pertractantur in illa doctrina, in qua ponuntur ea quae sunt communia omnibus entibus, quae habet subiectum ens in quantum est ens. *Ibid.*

<sup>61</sup> Est autem alius modus cognoscendi huiusmodi res, non secundum quod per effectus manifestantur, sed secundum quod ipsae se ipsas manifestant. Et hunc modum ponit Apostolus I Cor. 2: 'Quae sunt dei, nemo novit nisi spiritus dei. Nos autem non spiritum huius mundi accepimus, sed spiritum qui a deo est, ut sciamus'. *Ibid.*

<sup>62</sup> Sic ergo theologia sive scientia divina est duplex. Una, in qua considerantur res divinae non tamquam subiectum scientiae, sed tamquam principia subiecti, et talis est theologia, quam philosophi prosequuntur, quae alio nomine metaphysica dicitur. Alia vero, quae ipsas res divinas considerat propter se ipsas ut subiectum scientiae, et haec est theologia, quae in sacra scriptura traditur. *Ibid.*

## Chapter 3

### *The Cognitive Status of Natural Science and Theology*

In the last chapter our attention was focused on the divisions of the speculative sciences. This involved a prolonged study of how their respective intelligible objects are derived from the data of concrete individuals by the intellectual operation of abstraction. Now we are in a position to examine in detail the nature and consequences of the epistemological rupture found within the single science of metaphysics. In particular we will be interested in how this rupture effects the cognitive status of the theories developed in natural science and that branch of metaphysics known as theology. Mathematics and the study of being-in-general (which for convenience I will refer to as 'metaphysics proper', as opposed to 'first philosophy' or 'theology') are no longer central to our concerns and will not be examined further. Mathematics and metaphysics proper are, of course, crucial to the proper understanding of natural science and theology insofar as they are a part of the intellectual context in which the latter are found. And the science of metaphysics proper has the added significance of being the source of the common principles used in all of the sciences. However, neither of these sciences is crucial to our debate in the realist dispute in science because the intelligible objects of mathematics and metaphysics proper differ only in degree from those of natural science. While there are important differences between them, the intelligible objects of natural science, mathematics and metaphysics proper are nonetheless all products of abstractions from concrete individuals. Our interest in theology stems from the fact that its intelligible objects are not obtained in this way. Consequently, there is a difference in kind between the objects of theology and those of the other sciences. And given that we are concerned with the realist dispute in science, as opposed to mathematics or metaphysics, we can proceed by considering the nature and consequences of the epistemological rupture with reference to natural science and theology alone.

#### *The Epistemological Rupture in Metaphysics*

The epistemological rupture noted in our study of the science of metaphysics has already brought to our attention the existence of qualitatively distinct intelligible objects of study, viz., those gained via a



process of abstraction, and those which are not. What needs to be established now is that those objects obtained via abstraction enjoy a particular cognitive status and are investigated in a manner radically unlike those not obtained via abstraction. We need to know why intelligible objects not reached through a process of abstraction need to be treated differently from those that are. A closer examination of the notion of scientific knowledge employed by Aristotle and Aquinas as defined in the *Posterior Analytics* will throw light on this matter. Finally, we can consider some concrete examples of these principles at work. Aquinas' treatment of God, angels and certain problems in physics and cosmology will provide instructive test cases in this regard.

It is not difficult to establish that the qualitative difference in intelligible objects noticed in our study of the divisions of the speculative sciences is accompanied by significant differences in methodology and cognitive status. We are constantly reminded throughout Aristotle's works and Aquinas' commentaries that different objects of study require different treatment and different standards of proof. In *De Caelo* for example we are told that

perceptible things require perceptible principles, eternal things eternal principles, corruptible things corruptible principles; and, in general, every subject matter principles homogeneous with itself.<sup>1</sup>

The need to choose principles and methods appropriate to one's subject matter is emphasised by Aquinas in the *De Trinitate*. He writes:

. . . they are in error who try to proceed in the same way in these three parts of the speculative sciences.<sup>2</sup>

And in case there could be any misunderstanding of the importance laid on the principle of methodological pluralism we are told in no uncertain terms that

. . . it is the mark of an educated man to look for precision in each class of things just so far as the nature of the subject admits; it is evidently equally foolish to accept probable reasoning from a mathematician and to demand from a rhetorician scientific proofs.<sup>3</sup>

The recognition of this need to adjust one's methods and expectations to

the nature of the subject matter is exemplified in passages throughout Aristotle's corpus. One such passage is worth considering closely. In *On Meteorology* Aristotle begins a discussion concerning comets by stating at the outset what sort of proof is to be expected in this particular area. Aquinas' commentary on this passage is particularly revealing and can be taken as a brief encapsulation of the nature and consequences of the epistemological divide as manifested in the speculative sciences. Indeed the rest of this chapter can be seen as an extended exposition of this passage since it contains in germ all the significant characteristics of the Aristotelio-Thomist approach to the sciences. The following is Aquinas' commentary:

. . . he [Aristotle] explains the type of certitude to be sought in this matter and says that with respect to such things, *not accessible to sense observation*, one must not look for a certain and necessary demonstration, as found in mathematics and in the phenomena *accessible to sense*. It is enough to demonstrate with an argument and present a cause, in such a way as to solve the problem with *some possible solution from which nothing impossible follows, according to what here appears to sense*.<sup>4</sup>

What is made perfectly clear from the above passages is that the first order of business when starting any inquiry is to determine what principles, methods and expectations are appropriate to the object of study. And of particular interest to us is the recognition of what I will call two distinct 'realms' within the sciences. There is one realm comprised of individuals accessible to sense observation about which necessary demonstrations are at least theoretically possible. And there is another realm comprised of individuals not accessible to sense observation about which one can only hope to formulate 'possible solutions'. In the terminology of Part I, we would say there is a realm about which statements and theories can be formulated which are candidates for a realist interpretation, and another about which we can formulate theories for which we can never legitimately claim more than Empirical Adequacy. And rather than employing the 'sensible'/'non-sensible' dichotomy, we speak of terms which cross translation determinately and those that do not. It is worth noting that for Aristotle and Aquinas the difference between these two realms in terms of one's cognitive expectations is great enough that, strictly speaking, the term 'science' cannot be used in both realms without qualification. In fact

there can be 'science' of those entities not accessible to sense observation in only a qualified sense (in the sense that they too can be the object of rational inquiry of a sort) because our theories of such things always fall short of the certainty required of scientific knowledge. Aquinas writes:

. . . the ultimate end that rational inquiry ought to reach is the understanding of principles, in which we resolve our judgements. And when this takes place, it is not called a rational procedure or proof but a demonstration. Sometimes, however, rational inquiry cannot arrive at the ultimate end, but stops in the course of the investigation itself; that is to say, *when several possible solutions still remain open to the investigator*. This happens when we proceed by means of probable arguments, which by their nature produce opinion or belief, but not science.<sup>5</sup>

Given that there are two distinct realms within the Aristotelio-Thomist framework, one accessible to sense observation and one not, we now need to determine why this difference should so decisively determine one's cognitive expectations. We know that the difference has something to do with the operation of abstraction; but this is just the beginning of an answer. The complete answer to this question lies in the nature of scientific knowledge as understood by Aristotle and Aquinas, and begins with the recognition that the goal of science is not the collection of facts about the world, but the collection of *reasoned* facts. It is an important start to be able to say *that* something is such and so; but science in the Aristotelio-Thomist sense is obtained only when the investigator can explain *why* something is such and so. As Aristotle and Aquinas repeatedly say, science is knowledge *per causam*.<sup>6</sup> One only knows *x* scientifically when one knows the causes of *x*'s necessarily being as it is. This emphasis on the reasoned fact as the goal of science is reflected in the opening chapter of the second book of the *Posterior Analytics* where Aristotle lists the four questions an investigator asks about any given *x*. The investigator asks, i) *an est?* - does *x* exist?, ii) *quid est?* - what is *x*?, iii) *quia?* - is it the case that *y* can be predicated of *x*?, and iv) *propter quid?* - why does *x* possess property *y*?<sup>7</sup> When the investigator is able to formulate answers to these questions about *x* (especially ii and iv) he can be said to know *x* scientifically.

The relevance of Aristotle's insistence on the importance of the reasoned

fact for our purposes becomes clear when one realises what is required in order to produce a 'reasoned fact'. The demonstrative syllogism is the key to Aristotle's understanding of scientific knowledge as presented in the *Posterior Analytics*, because the conclusions of such syllogisms are the reasoned facts which are the goal of science. But in order to be able to explain why property  $y$  necessarily belongs to  $x$  (a demonstration *propter quid*) one needs to be able to connect  $y$  to  $x$  via the definition of  $x$  in order to show that the nature of  $x$  is such that it cannot be without  $y$ . Consequently the success of the scientific project outlined in the *Posterior Analytics* (which outlines what a *completed* science will look like) depends upon the investigator's ability to arrive at definitions of his chosen intelligible object. This search for definitions is in fact the central activity of the investigator, especially in the early stages of the inquiry.<sup>8</sup> Once definitions are found one can begin the process of presenting one's conclusions in the form of an axiomatic-deductive system as outlined in the *Posterior Analytics*.<sup>9</sup>

How definitions are obtained by the investigator cannot be studied in full here. There are certain criteria that a successful definition must meet, and Aristotle provides a long series of tests one can apply to suggested definitions.<sup>10</sup> But there are no illusions about the difficulty of the task. In fact Aquinas states that a final definition of intelligible objects of the natural sciences is not achievable in most cases.<sup>11</sup> Nonetheless, there remains a significant epistemological difference between intelligible objects obtained via abstraction from concrete individuals and those which are not. Individuals accessible to sense observation are those about which the intellect can achieve at least a vague and rudimentary understanding once some experience is had of them and the operation of abstraction has been performed. From this humble beginning the investigator can then work towards a more precise, scientific definition which expresses the essence of the entity. As McMahon writes, "the starting point" of any investigation "is a general and confused knowledge which by a process of concretion approaches the particular and the distinct"; and "it is natural that we have at least a confused idea of the meaning of a word before we can give a strict definition of it."<sup>12</sup> This advancement from general, rudimentary definitions to specific and more sophisticated ones is reminiscent of Putnam's distinction between stereotypic definitions of terms as used and understood by laymen, and the definitions of the

same terms used by experts.<sup>13</sup> The rudimentary definitions of laymen are not strictly speaking incorrect; they simply do not reflect the essence of the intelligible object as completely and as precisely as the more strict definition of the expert. As Gilby writes, ". . . the knowledge of any particular material being is progressive from most general 'whatnesses' to more and more specific notes as experience uncovers new facets. . ." <sup>14</sup> The key point for us is that each improvement on the definition of an intelligible object makes the definition more complete; improvements do not lead to radically new definitions of intelligible objects by over-turning or rejecting key components of a previous definition. In this way our knowledge of these intelligible objects is genuinely accumulative or progressive.

Although this progression from rudimentary definitions to strict scientific definitions is arduous, it is not impossible in principle. But as will be shown in detail below, *what is impossible is the attainment of a scientific definition of an individual of which one cannot achieve even a rudimentary definition to start with by means of abstraction.* Why this is so will be discussed presently. For the moment it is important that the significance of this point be recognised. Since individuals not accessible to sense observation cannot be strictly defined, they cannot be known scientifically in the Aristotelio-Thomist sense.<sup>15</sup> As will be shown below, the best we can hope to achieve concerning non-sensible individuals is a demonstration of their existence (answering the first question: *an est?*). But since we can never know *what x* is since we can never know its essence as expressed in a strict definition, no *propter quid* demonstration can be formulated. The result is that there can be no completed science in the sense outlined in the *Posterior Analytics* of non-sensible individuals. The upshot of this is that such entities must be approached in a different manner and with different cognitive expectations.

### *The Investigation of 'Non-Sensible' Individuals*

So how one is to proceed in an investigation of non-sensible entities? In all cases of investigation in the speculative sciences the goal of the Aristotelio-Thomist is the achievement of an understanding of the nature of the object of study. What distinguishes one realm from

another is the extent to which the goal is achievable *in toto*. Now, in accordance with his commitment to empiricism, Aquinas states that the intellect can come to know something of *x* in two ways - either directly through the form of *x* itself, or from a form of something similar to *x*, as a cause is known through the likeness of its effect.<sup>16</sup> Now in the case of non-sensible individuals the intellect is unable to know them directly through its form because forms are known directly only when abstracted by the agent intellect from concrete individuals accessible to sense observation. Consequently, the intellect has no alternative but to *infer* the nature of a non-sensible individual from the nature of its sensible effects. This is the distinguishing characteristic of the investigation of non-sensible entities. This immediately raises the question concerning the extent to which the nature of a non-sensible cause can be known from its sensible effects alone. Aquinas' considered opinion is that from sensible effects with no sensible cause, one can infer *that* a non-sensible cause exists - the operating assumptions being a) that *all* effects have a cause, not just ones for which a sensible cause has been found, and b) that *esse* is not *percipi*. But, as will be examined shortly, Aquinas maintains that sensible effects do not *adequately reveal the nature of their non-sensible causes*. Such investigations are therefore incomplete with respect to the four scientific questions identified in the *Posterior Analytics*. Before discussing this thesis in detail it would be helpful to consider an example from natural science illustrating how sensible effects can be used to demonstrate that a cause exists. Then we can focus our attention on the notion of the 'adequacy' of effect to cause, and thereby illustrate why *propter quid* demonstrations cannot be had of causes from their sensible effects alone.

The first question an investigator must ask when embarking on any investigation is whether his chosen object of study actually exists.<sup>17</sup> The Aristotelio-Thomist procedure is to establish first that the theoretical entity can be said to exist, and only then to begin to investigate its nature. This insistence on the proper order of investigation is based on the principle that only actual existing individuals have a nature which can be known. Chimera, like all imaginary entities, cannot be known in a scientific manner simply because there is no nature or essence to come to know.<sup>18</sup> Nevertheless, the investigator must have *some* idea of the nature of the

theoretical entity whose existence is in question in order to conceive of it and postulate its existence at all. This poses a problem of circularity. In order to establish that  $x$  has a nature which can be studied the investigator must know that  $x$  actually exists; but in order to establish that  $x$  exists he must first know something of  $x$  in order to recognise an actual  $x$  should he come across one.

This problem is easily over-come. When faced with the task of proving that thunder exists (to take a time honoured example) there is no need for the investigator to know the nature or essence of thunder as expressed in a strict scientific definition. In fact nothing of thunder's essential nature need be known. It is enough that there be some accident or effect associated with thunder. For example, part of the meaning of 'thunder' is that it is the cause of certain sensible effects, viz., noise in the clouds. As Aquinas says:

. . . there are descriptions of a thing other than its definition. They are either descriptions which explain what the word signifies, or descriptions of the thing itself, which differ from the definition. They do not signify what a thing is, as the definition does, but perhaps some accident of it.<sup>19</sup>

The investigator can then use these accidents or effects as the middle term in a demonstrative syllogism with the conclusion that thunder exists<sup>20</sup>:

- 1) Thunder is the cause of noise in the clouds.
- 2) Noise in the clouds exists
- 3) Thunder exists.

Such a demonstration provides an answer to the question, 'an est?'. And we can now say we know *that* thunder exists, i.e., we have a demonstration *quia*. The middle term in this case, far from being a definition of thunder, expresses what Aquinas calls the *significatio nominis* or the nominal definition of entity whose existence is in question. By following this procedure the investigator can begin his study with only 'accidental' knowledge of thunder's existence; yet he has established that thunder exists by noting the occurrence of particular noises in the clouds, for his object of study is none other than *the cause of noise in the clouds*.

Although the investigator can now proceed with his investigation of thunder confident that his object of study does exist, and hence has a nature to be known, it is perfectly clear that 'cause of noise in the clouds' is not the definition of thunder. It still remains to determine *what* thunder actually is in itself. It then becomes a matter of some importance to determine whether or not the nature of thunder can be safely inferred from the nature of its sensible effects. We can now consider what Aquinas held to be the case in such matters by focusing on the distinction between 'adequate' and 'inadequate' effects.

Effects, says Aquinas, can be divided into two categories. There are effects which are 'equal' to, or 'adequate' to, the power of their cause, and those which are not.<sup>21</sup> The import of this distinction is the following: In *De Trinitate*, q. 1, a. 2, Aquinas maintains that the essence of a cause can be known 'completely' or 'perfectly' through those of its effects which are adequate to it. On the other hand, when effects are not adequate to their cause nothing can be inferred regarding the nature of the cause despite the fact that its existence is established.<sup>22</sup> But this is precisely the situation in which our investigator finds himself once he has established that thunder exists by noting the existence of an accident of thunder, viz., noise in the clouds. Accordingly Aquinas can say that:

As often as we have accidental knowledge that the thing exists, we must be in a wholly negative state as regards awareness of its essential nature. . . . Thus it follows that the degree of our knowledge of a thing's essential nature is determined by the sense in which we are aware that it exists.<sup>23</sup>

'Accidental knowledge' that something exists gleaned from noting its sensible effects tells us nothing about the essential nature of the thing in question because accidental effects are not 'adequate' to their cause. But what makes one effect adequate and another inadequate with respect to its cause? In q. 45, a.7 of the *Summa Theologiae* Aquinas states that some effects *reveal the nature* of their cause because they actually *reproduce* the form of the cause, as a child reproduces the form of the parent, while other effects can only *signify the presence* of a cause, as smoke indicates fire.<sup>24</sup> Again in q. 13, a. 5 Aquinas speaks of effects which 'receive the similitude of the cause, 'in its full degree'. Effects which receive the similitude, or form, of the cause in its full



degree adequately reveal the nature of that cause - otherwise they do not.<sup>25</sup> This distinction is similar to that drawn in *De Generatione et Corruptione* where Aquinas distinguishes between pairs of causes and effects which share a common form and pairs which do not, the distinction being between causes and effects which are *essentially* related and causes and effects related only *accidentally*.<sup>26</sup> With this notion of adequacy in mind we can see why noting the existence of noise in the clouds can tell us that thunder exists, but not what thunder is in itself. There is no formal identity between thunder and sound, and consequently sound cannot adequately reveal the nature of thunder. But we can also see why the sensible effects of a non-sensible cause will never be adequate to their cause; for if the effect itself is sensible while its cause is not, then cause and effect do not share the same form. If  $x$  and  $y$  have the same form, i.e. are the same sort of thing, then both will either be accessible to sense observation, or both will not be accessible to sense observation - but it is not possible that one member of a kind be accessible to sense observation while another of the same kind is not. The relationship of sensibility to materiality, and non-sensibility to immateriality is maintained throughout Aquinas' commentaries on Aristotle's scientific works: if  $x$  is material, then  $x$  is in principle accessible to sense observation (and vice versa); if  $x$  is immaterial, then  $x$  is in principle not accessible to sense observation (and vice versa).<sup>27</sup> But there is no natural kind some of whose members are corporeal while others are incorporeal. Now if the cause and the effect do not share the same form, then the effect is related to the cause only accidentally, and can reveal nothing of the cause's essential nature.

This understanding of adequacy is at work in Aquinas' treatment of our knowledge of those entities not accessible to sense observation, namely, God and the angels. In the first question of the *De Trinitate* Aquinas deals with the question concerning the extent to which the human intellect can know God in this life. This question is raised in the context of a general discussion on the Trinity, and in particular on the matter of whether or not the intellect can establish anything in this area, or whether the Trinity must be accepted as an article of faith. Aquinas' position in the end is that while the intellect can know *that* God exists, nothing can be known of his nature, and *a fortiori* that nothing can be known in a scientific manner of the Trinity. That God is

Three in One remains an article of faith which is beyond the abilities of the intellect to establish scientifically.<sup>28</sup> Why Aquinas is driven to this conclusion is explained in the second article of the first question where he introduces the notion of 'adequacy'. Now Aquinas maintains in this article and elsewhere that none of God's effects are 'adequate' to their creator, and that consequently nothing can be known of God's nature by the intellect in this life.<sup>29</sup> Indeed, the point of departure of any discussion of God's nature must be that he is radically *other* than his effects. In a sense his effects do provide some *negative* indication of what God is like; for whatever God is, he is *not* like anything we know.

Now it is of some considerable importance that we understand why God's effects are inadequate to reveal his nature. Some may be tempted to argue that God's effects are inadequate because of the lack of ontological proportion which obtains between created effects and the Creator. This unbridgable gulf between the ontological status of the Creator, who exists necessarily and from all eternity, and all creatures, whose being is dependent upon the Creator, radically contingent and finite, is surely enough to explain why created effects are not adequate to reveal the nature of their cause. The ontological status of a cause and its effect might then quite naturally be taken to be an important factor in determining whether an effect is 'adequate' to its cause. In particular, it might be thought that while no creature could ever adequately reflect the nature of the Creator, this would not rule out the possibility that creatures might adequately reflect the nature of other creatures. It could then be maintained that the effects of non-sensible but *created* entities may be adequate to their causes given that the ontological gulf between Creator and created does not obtain. This view gains some support from the fact that Aquinas clearly states that the ontological gulf between the Creator and his creation is greater than the gulf existing between any one created entity and another.<sup>30</sup>

Now it is undeniable that the inadequacy of created effects with respect to the Creator is due to a lack of ontological proportion. However, this is not to say that other non-sensible but created entities might be completely knowable despite the fact that they are not accessible to sense observation. For even if one were to accept that ontological proportion of creature to creature were a determining factor of adequacy, one could still argue that there remains a significant

ontological gulf between the non-sensible but created entities and their sensible effects given that angels are wholly *immaterial* while their sensible effects will be observed in and on concrete *material* individuals. Consequently, one could maintain that *all* non-sensible entities ontologically transcend their sensible effects, not just God, and that therefore all sensible effects will be inadequate with respect to any non-sensible entity. And this is in fact what Aquinas maintains, as is clear from q. 12, a. 2 of the *Summa Theologiae*: "By the likeness of a body the essence of an incorporeal thing cannot be known." But given Aquinas' remarks about adequate effects revealing the nature of their cause by reproducing the form of the cause, one ought to say that ontological proportion of cause and effect is a necessary condition of adequacy of effect to cause; but this now holds as a matter of course since causes and effects which are essentially related obviously have the same status in the hierarchy of being. So ontological proportion is no longer a sufficient condition given that adequacy requires the further condition that cause and effect be identical from the point of view of their form, and not merely that both cause and effect be creatures (as the example of fire and smoke indicates).

This interpretation of the meaning of 'adequate' is more intuitively plausible and is in much better accord with the spirit of Thomist empiricism. But it would be well to establish this beyond doubt because of the significance of the point at issue. For if Aquinas' treatment of God is to be generalisable in any way, it must be clear that God is not entirely unique from an epistemological point of view. For if God's nature cannot be known solely on the grounds that no created effect is adequate to an uncreated entity, then Aquinas' investigations in natural theology would shed no light on our problem in the realist dispute in science - for we are not concerned with investigating the nature of an uncreated entity. But God is not unique insofar as his nature cannot be known via his sensible effects; for all immaterial, non-sensible entities have this feature in common. Any entity which is not accessible to sense observation will pose a common set of problems from the point of view of Aquinas' philosophy of science, whether that entity be God, the angels, or sub-atomic particles. Let us take the time then to review why the adequacy of an effect to its cause cannot be simply a function of their being ontologically proportional, but rather a function of their formal identity.

The first reason for asserting that the adequacy of an effect to its cause depends upon the identity of their forms rather than on their being merely ontologically proportional is the fact that in the second article of the first question of *De Trinitate* Aquinas says one can know the nature of a cause 'completely' and 'perfectly' from its effects if they are adequate. Now it would be particularly surprising if adequacy were merely a matter of ontological proportion given the fact that Aquinas points out that complete knowledge of sensible concrete individuals of which one has direct experience is itself not always attainable.<sup>31</sup> It seems odd then to think that one could have perfect knowledge of an object of which one never has any direct sensory experience. The relationship between sensory data and knowledge is made clear in passages where Aristotle says explicitly that knowledge of certain sensible entities is difficult to come by if few of their accidents fall under our senses<sup>32</sup>. Aquinas echoes this in a passage from the *Summa Contra Gentiles*:

. . . the intellect can scarcely reach perfect knowledge of a lower nature, even in the case of those natures whose accidents it comprehends perfectly through the sense. Much less will the intellect arrive at comprehending the natures of those things of which we grasp few accidents by sense; and it will do so even less in the case of those things whose accidents cannot be grasped by the senses, though they may be perceived through certain deficient effects.<sup>33</sup>

This passage states in no uncertain terms that our level of knowledge of an entity decreases as the number of its accidents accessible to sense observation decreases, and that our knowledge is poorest of those entities perceived only 'through certain deficient effects'. Now non-sensible entities are only 'perceived' through their effects; consequently we can expect our knowledge of them to be anything but 'complete'. And we have already seen that:

The degree of our knowledge of a thing's nature is determined by the sense in which we are aware that it exists.<sup>34</sup>

In the same place Aristotle also says that as long as we have only accidental knowledge that a thing exists, which is precisely how we know that a non-sensible cause exists,

we must be in a wholly negative state as regards awareness of its essential nature.<sup>35</sup>

However, these passages fit perfectly with the view that the adequacy of an effect to its cause depends on the identity of their forms. There is no need to make inferences concerning the form of the parent from an effect which is essentially related (in this case a child) because the forms of both are identical: to know the form of the one is to know the form of the other.

A second reason for denying that adequacy is a matter of ontological proportion alone is that Aquinas himself points out that safely inferring the nature of a cause from its sensible effects alone is impossible. Perhaps the most important difficulty is precisely that causes and effects need not be essentially related.<sup>36</sup> When one posits a cause which is in principle not accessible to sense observation in order to account for a sensible effect, there is no guarantee that the cause and effect are related essentially; indeed, the very fact that one is sensible and other is not is enough to establish that the cause and effect *are not* essentially, but only accidentally, related. Aquinas also points out in *Summa Theologiae*, q. 32, a.1, that he is fully aware of the general difficulty we have referred to as the under determination of theory by data. Since many explanations can be formulated to account for an effect which are internally consistent and empirically adequate, one is unable to determine with any certainty which causal explanation holds.<sup>37</sup> These difficulties on their own are enough to make it evident that the adequacy of effect to cause cannot be simply a matter of ontological proportion.

There are two more difficulties worth mentioning. At the beginning of this discussion we pointed out that if 'adequacy' were merely a matter of ontological proportionality, it would be possible to assume that the intellect could come to know the nature of angels in themselves (given that the ontological gulf between Creator and creature does not apply). However, as is clear from the *De Trinitate* and the *Treatise on Separate Substances*, Aquinas does not think the investigation of the nature of angels is within the purview of the philosopher. Their existence is posited for theoretical reasons (to account for the movement of the spheres, and to occupy a particular level in the Great Chain of Being)

and because they are mentioned in the scriptures. But all reliable 'knowledge' concerning the nature of angels is derived from the scriptures and is the special province of the theologian.<sup>38</sup> And finally we can ask why Aquinas would agree that theories regarding those things not accessible to sense observation should be limited to being only 'possible solutions'. If effects do adequately reveal the nature of their causes if they are ontologically proportional, it would be appropriate to assume that certainty in this realm should be possible at least in principle. But this is clearly not what either Aristotle or Aquinas maintain. It is quite obvious how the alternative interpretation of adequacy avoids these difficulties and fits nicely with the rest of the Thomist commitments. But if an effect adequately reveals the nature of its cause only when the pair are essentially related, the unavoidable conclusion is that our intellect can know nothing of the essential nature of entities not accessible to sense observation.

So how is one to proceed in areas where one must work only from knowledge of effects to knowledge of their cause? What can one hope to accomplish? From the foregoing discussion it is clear that in such situations our cognitive expectations must be severely limited. But one can establish the existence of theoretical entities by using their sensible effects as the middle term of demonstrations *quia*, as we saw in the case of thunder. This approach is exemplified in Aquinas' five proofs for the existence of God. Although there is much debate concerning the correct manner in which these proofs ought to be interpreted, it is not controversial to say that Aquinas takes the *significatio nominis* of God to be 'the creator and sustainer of the world', and that the proofs are meant to establish God's existence by drawing attention to the alleged effects of such an entity found in the realm of experience. However, once the existence of a hidden cause is established, one's theories about the nature of such entities can be defended, but never established conclusively. As stated in the passage quoted above from the *Meteorologicorum*,<sup>39</sup> one can only hope to show that one's theory is a 'possible solution' or explanation of the particular effects in question.

The defence of one's theory concerning entities not accessible to sense observation is then conducted on three levels. First, one must show that one's own theory is not impossible, i.e., that it is internally

consistent and empirically adequate. This procedure holds good in both the physical sciences<sup>40</sup> and in theological matters.<sup>41</sup> Conversely, one can attempt to show that competing theories are untenable without some further modification either because they are internally inconsistent or because they are not empirically adequate. This is often the mode of procedure used by Aristotle to reject scientific theories.<sup>42</sup> Finally, one can attempt to show that competing theories or claims *are not forced by the available evidence*, and consequently do not have the status of a *ratio sufficiens*. This procedure is perhaps most clearly exemplified in Aquinas' discussion of the arguments for and against the eternity of the world. In *De Aeternitate Mundi* he shows that the alleged proofs for the eternity of the world put forward by the Latin Averroecists are not conclusive, while the proofs for the creation of the world in time put forwarded by Bonavenature are plainly unacceptable.<sup>43</sup> The advantage gained by this procedure is that one can chose to accept one's own theory on these matters, provided they meet the criteria of internal consistency and empirical adequacy.

There are a number of serious errors which must be assiduously avoided, all arising from the failure to recognise the cognitive standard applicable to a theory or statement. First, one must avoid using statements or theories which are at best empirically adequate as premises of an argument the conclusion of which one is claiming to have established conclusively. Aquinas shows that he is aware of this practical point when he discusses how one is to argue with secular philosophers or with people of another faith.<sup>44</sup> This is a simple point arising out of the nature of argumentation: one cannot use as premises statements which your interlocutor does not grant, for premises must always be more certain than the conclusion which follows from them. In fact Aquinas is adamant that his fellow Christians must follow this rule if they are to avoid bringing their faith into disrepute amongst unbelievers. The converse of this rule is that one must not accept a theory or statement because it is empirically adequate if it is of the sort for which a *ratio sufficiens* ought to be expected. Finally, one must not look for or expect a *ratio sufficiens* for all statements and theories. As Aquinas writes of theories concerning the spiritual substances:

It is idle to urge that we may yet establish a theory properly devoted to them though hitherto it has not been discovered. For so long as we work with the scientific principles accessible

to us, all of which depend on knowledge acquired from material phenomena, complete spiritual understanding is bound to escape us.<sup>45</sup>

Aquinas backs this up with the following remark:

To strive for an end that cannot be secured is futile, and the hope of satisfaction there is illusory.<sup>46</sup>

These remarks are simply consequences of the principle of methodological pluralism stated at the outset of this chapter. One must recognise the nature of the subject matter under discussion and adjust one's cognitive attitude to suit the occasion. Failure to do this is the mark of the uneducated bungler.

This concludes our study of the intellectual apparatus employed in Aquinas' philosophy of science. We have seen that all the speculative sciences from natural science (physics) through to metaphysics proper are derived from analysis of concrete material individuals, precisely those objects whose linguistic counter-parts cross translation determinately. We have also seen how a branch of metaphysics (theology) is epistemically distinct from the rest of the sciences. This concluding chapter has examined the nature and consequences of this epistemological rupture for Aquinas' philosophy of science. We can now return to the realist dispute in science and consider how Aquinas' intellectual apparatus can help in our attempt to reconcile our realist and anti-realist tendencies by focusing on the analogies between his project and our own.

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<sup>1</sup> *De Caelo*, Book III, ch. 7, in *The Basic Works of Aristotle*. Ed. Richard Mckeon. New York: Random House, 1941.

<sup>2</sup> Et propter hoc peccant qui uniformiter in his tribus speculativae partibus procedere nituntur. *Expositio Super Librum Boethii De Trinitate*, q. 6, a. 2. Leiden: E.J. Brill, 1955.

<sup>3</sup> *Ethica Nicomachea*, Book I, ch. 3 1094b 23-28. In *The Basic Works of Aristotle*. See also *Metaphysics*, Book IV, ch. 3, 1006a 4-8.

<sup>4</sup> Et primo ostendit modum certitudinis qui est in hac materia exquirendus. Et dicit quod de talibus, quae sunt immanifesta sensui, non est exquirenda certa demonstratio et necessaria, sicut in mathematicis et in his quae subiacent sensui; sed sufficit per rationem demonstrare et ostendere causam, ita quod quaestionem solvamus per aliquam solutionem possibilem, ex qua non sequatur aliquod inconveniens, per ea quae hic apparent secundum sensum. *Meteorologicorum*, L. I, 1.



xi, no. 68. Romae: Marietti, 1952. English translation by R.F. Larcher and Pierre Conway.

<sup>5</sup> Ultimus enim terminus, ad quem rationis inquisitio perducere debet, est intellectus principiorum, in quae resolvendo iudicamus; quod quidem quando fit non dicitur processus vel probatio rationabilis, sed demonstrativa. Quandoque autem inquisitio rationis non potest usque ad praedictum terminum perduci, sed sistitur in ipsa inquisitione, quando scilicet inquirenti adhuc manet via ad utrumlibet; et hoc contingit, quando per probabiles rationes proceditur, quae natae sunt facere opinionem vel fidem, non scientiam. *De Trinitate*, q. 6, a. 1. English translation by Maurer. My italics appear in the English text.

<sup>6</sup> See Aristotle's *Posterior Analytics*, Book I, ch. 2, and *Metaphysics*, Book I, ch. 2. See Aquinas' commentary in *In Posteriorum Analyticorum*, L. I, l. iv, for an extended discussion of this matter. Romae: Marietti, 1955.

<sup>7</sup> See *Posterior Analytics*, Book II, ch. 1, and Aquinas' commentary thereon in *In Posteriorum Analyticorum*, L. II, l. i.

<sup>8</sup> Book II of the *Posterior Analytics* is devoted to the nature of definitions and their role in demonstrative syllogisms.

<sup>9</sup> A completed science is a set of propositions about a particular intelligible object which follow deductively from a common set of axioms, the definitions of the intelligible object and its accidents, and the necessary existence claims.

<sup>10</sup> See in particular Aristotle's *Topics*, Books IV and VI.

<sup>11</sup> Aquinas writes concerning the limitations of our knowledge that, "The essential principles of things are unknown to us." (*In De anima* I, l. 1.); "Substantial forms are *per se* unknown to us." (*De spiritualibus creaturis* II ad 3); and, "We do not know even the essence of a fly." (*In Symbolo apostolorum* I). We also find the following: ". . . the intellect can scarcely reach the perfect knowledge of a lower nature, even in cases of those natures whose accidents it comprehends perfectly through the sense. Much less will the intellect arrive at comprehending the natures of those things of which we grasp few accidents by sense. Intellectus vix per huiusmodi exteriora potest ad perfectam notitiam inferioris naturae pervenire, etiam illarum rerum quarum accidentia sensu perfecte comprehendit. Multo igitur minus pertingere poterit ad comprehendendum naturas illarum rerum quarum pauca accidentia capimus sensu. *Summa Contra Gentiles*, IV, cap. 1, n. 3340. English translation by Pegis, Anderson, Bourke and O'Neal. Found in *The Pocket Aquinas*. Ed by Bourke. New York: Pocket Books, 1960, p.318-319.

<sup>12</sup> George McMahon, "The Prooemium to the Physics of Aristotle", in *Laval Théologique et Philosophique*. Vol. 13, 1957, p. 10 and p. 53.

<sup>13</sup> See Putnam's "The meaning of "meaning"" and other papers in the second volume of *Philosophical Papers*. I rely here on Hacking's discussion in *Representing and Intervening*, in particular the chapter on Reference.

<sup>14</sup> Aquinas makes precisely this point when he says, ". . . one with less complete science about the realities in nature has a general grasp of their genera, placing the heavenly bodies in one genus, earthly bodies in another, plants in another, animals in another; one with finished science of the natural can discriminate among the different species of heavenly bodies and of all the others." Sicut qui imperfecte cognoscit res naturales distinguit earum ordines in universali ponens, in uno ordine caelestia corpora, in alio corpora inferiora inanimata, in alio plantas, in alio animalia; qui autem perfectius cognosceret res naturales posset distinguere et in ipsis corporibus caelestibus diversos ordines et in singulis aliorum. *Summa Theologiae*, q. 108, a. 3.

<sup>15</sup> As Aquinas says in q. 12 a. 13 of the *Summa Theologiae*, knowledge gained by means of 'natural reason' alone requires two things: a) images derived from sensible things, and b) the process of abstraction. Dicendum quod per gratiam perfectior cognitio de Deo habetur a nobis quam per rationem naturalem. Quod sic patet: cognitio enim quam per naturalem rationem habemus, duo requirit: scilicet, phantasmata ex sensibilibus accepta, et lumen naturale intelligibile, cuius virtute intelligibiles conceptiones ab eis abstrahimus. In his commentary on the *Posterior Analytics*, Aquinas phrases these requirements using a different terminology. In L. I, l. xxx, n. 251 he says that scientific knowledge comes via two intellectual procedures,

namely deduction and induction. Now, in order to demonstrate one needs universals which serve as definitions one's subject terms. Induction, on the other hand, requires sense experience of particulars. But one cannot grasp universals except through induction. And, as already noted, induction is possible only through sense experience of particulars. Consequently, if one does not have direct sensory experience of *x*, scientific knowledge of *x* is impossible.

<sup>16</sup> Dicendum quod dupliciter aliqua res cognoscitur. Uno modo per formam propriam, sicut oculus videt lapidem per speciem lapidis. Alio modo per formam alterius similem sibi, sicut cognoscitur causa per similitudinem effectus et homo per formam suae imaginis. *De Trinitate*, q. 1 a. 2.

<sup>17</sup> The question 'what is it?' follows on from the question 'does it exist?' Quia quaestio *quid est*, sequitur as quaestionem *an est*. *Summa Theologiae*, q. 2, a. 2, ad 2. The same point is made in the commentary on the *Posterior Analytics*: The question, 'does it exist?', is prior to the question, 'what is it?' Unde quaestio, *an est*, praecedit quaestionem, *quid est*. *In Posteriorum Analyticorum*, L. I, l. II, n. 17. English translation by Christopher Martin.

<sup>18</sup> That which does not exist has no quiddity or essence: so no-one can know what something that does not exist is. . . it is impossible to know what [a] goat-stag is, because it is nothing in reality. Quia enim *non entis non est aliqua quidditas vel essentia*, de eo quod non est, nullus potest scire quod quid est. . . impossibile est scire quod quid est hircocervi, quia nihil est tale in rerum natura. *In Posteriorum Analyticorum*, L. II, l. vi, n. 461. English translation by Christopher Martin.

<sup>19</sup> Invenitur autem aliqua alia ratio rei praeter definitionem: quae quidem vel est ratio expositiva significationis nominis, vel est ratio ipsius rei nominatae, altera tamen a definitione, quia non significat *quid est*, sicut definitio, sed forte aliquod accidens. *In Posteriorum Analyticorum*, L. II, l. viii, n. 484. English translation by Christopher Martin. Wittgenstein makes this interesting point concerning scientific definitions: "The fluctuation of scientific definitions: what to-day counts as an observed concomitant of a phenomenon will tomorrow be used to define it." No. 79 of *Philosophical Investigations*. Aquinas always distinguishes between the signification nominis and a proper definition of *x*.

<sup>20</sup> When a cause is being proved by means of its effect, we have to use the effect in the place of the definition of the cause, in order to prove that the cause exists. Dicendum quod cum demonstratur causa per effectum, necesse est uti effectu loco definitionis causae, ad probandum causam esse. *Summa Theologiae*, q. 2, a. 2, ad 2. English translation by C. Martin.

<sup>21</sup> Now effects are of two kinds. One is equal to the power of its cause, and through an effect of this sort the power - and consequently the essence - of the cause is fully known. The other effect falls short of the above-mentioned equality, and through such an effect the powers of the agent cannot be fully grasped and consequently neither can its essence: we only know that the cause exists. Effectus autem est duplex: quidam, qui adaequatur virtuti suae causae, et per talem effectum cognoscitur plenarie virtus causae, et per consequens quidditas ipsius; alius effectus est, qui deficit a praedicta aequalitate, et per talem effectum non potest comprehendi virtus agentis et per consequens nec essentia eius; sed cognoscitur tantum de causa quod est. *De Trinitate*, q. 1, a. 2. English translation by Maurer.

<sup>22</sup> See last line of note 23, and *De Trinitate*, q. 6, a. 4, ad 2.

<sup>23</sup> Decit quod illa de quibus scimus quia sunt per aliquod accidens ipsorum, nullo modo per hoc se habent ad hoc quod cognoscamus de ipsis *quid est*. . . . Unde manifestum est quod sicut nos habemus ad cognoscendum quia est aliquod, ita nos habemus ad cognoscendum *quid est*. *In Posteriorum Analyticorum*, L. II, l. vii, n. 476. English translation by F.R. Larcher. Now effects are of two kinds. One is equal to the power of its cause, and through an effect of this sort the power - and consequently the essence - of the cause is fully known. The other effect falls short of the above-mentioned equality, and through such an effect the powers of the agent cannot be fully grasped and consequently neither can its essence: we only know that the cause exists. Effectus autem est duplex: quidam, qui adaequatur virtuti suae causae, et per talem effectum cognoscitur plenarie virtus causae, et per consequens quidditas ipsius; alius effectus est, qui deficit a praedicta aequalitate, et per talem effectum non potest

comprehendi virtus agentis et per consequens nec essentia eius; sed cognoscitur tantum de causa quod est. *De Trinitate*, q. 1, a. 2. English translation by Maurer.

24 Dicendum quod omnis effectus aliquo modo repraesentat suam causam, sed diversimode. Nam aliquis effectus repraesentat solam causalitatem causae, non autem formam eius, sicut fumus repraesentat ignem; et talis repraesentatio dicitur esse repraesentatio *vestigii*; vestigium enim demonstrat motum alicuius transeuntis, sed non qualis sit. Aliquis autem effectus repraesentat causam quantum ad similitudinem formae eius, sicut ignis generatus ignem generatorem. . . ; et haec est repraesentatio *imaginis*. *Summa Theologiae*, q. 45, a. 7.

25 Quia omnis effectus non *adaequans* virtutem causae agentis recipit *similitudinem agentis*, non secundum eandem rationem, sed deficienter. *Summa Theologiae*, q. 13, a. 5.

26 In his commentary on *De Generatione et Corruptione*, L. 1, l. xlii, n. 94, Aquinas notes that while every thing is caused by something else, causes and effects need not be in the same genus or species. 'That which is generated has to be generated by some agent in act which is either 'homogeneous' i.e., of one form or species. . . or else it is required at least that something be generated by something existing in act, or by the action of something existing in act, even though the agent be not akin to the thing generated in genus or species, as when something hard is generated by something not hard - for example, when milk is solidified by fire.' Oportet etiam quod id quod generatur, generetur ab aliquo agente ente in actu aut *homogeneous*, id est quod sit saltem unius generis, aut *homoideos*, id est quod sit saltem unius formae vel speciei . . . aut oportet quod saltem ab aliquo actu existente, sive ab actione alicuius actu existentis, aliquod generetur, etiam si generans non sit simile generato in genere seu specie, sicut durum generatur a non duro, puta cum lac induratur per ignem. When cause and effect share the same form they are related *per se*; if their forms are not identical they are only related *per accidens*. English translation by Larcher and Conway.

27 This point is made clear in the following passage: It is impossible for God to be seen by the sense of sight, or by any other sense or power of the sensitive part of the soul. For every such power is the act of a corporeal organ . . . . Now act is proportioned to the being whose act it is. Hence no power of that kind can go beyond corporeal things. But God is incorporeal, as was shown above. Hence, He cannot be seen by the sense or the imagination, but only by the intellect. Dicendum Quod impossibile est Deum videri sensu visus, vel quocumque alio sensu aut potentia sensitivae partis. Omnis enim potentia huiusmodi est actus corporalis organi . . . . Actus autem proportionatur ei cuius est actus. Unde nulla huiusmodi potentia potest se extendere ultra corporalia. Deus autem incorporeus est, ut supra ostensum est. Unde nec sensu, nec imaginatione videri potest, sed solo intellectu. *Summa Theologiae*, q. 12, a. 3. English translation by Pegis.

28 There are some truths which do not come within the range of these principles (i.e. the power of the agent intellect) . . . like the truths of the faith, which transcend the faculty of reason. Quaedam vero sunt ad quae praedicta principia non se extendunt, sicut sunt ea quae sunt fidei. *De Trinitate*, q. 1, a. 1. English translation by Larcher and Conway. In fact to know anything in this domain requires divine inspiration: The human mind cannot know these without being divinely illumined by a new light supplementing the natural light. Et haec cognoscere mens humana non potest, nisi divinitus novo lumine illustretur superaddito lumini naturali. This position is repeated in q. 12, a. 5 of the *Summa Theologiae*: when any created intellect sees the essence of God, the essence of God itself becomes the intelligible form of the intellect. Hence it is necessary that some supernatural disposition should be added to the intellect in order that it may be raised up to such a great height. Cum autem aliquis intellectus creatus videt Deum per essentiam, ipsa essentia Dei fit forma intelligibilis intellectus. Unde oportet quod aliqua dispositio supernaturalis ei superaddatur, ad hoc quod elevetur in tantum sublimitatem. English translation by Anton Pegis in his *Introduction to St. Thomas Aquinas*.

29. . . by the likeness of the inferior order of things, the superior can in no way be known; as by the likeness of a body the essence of an incorporeal thing cannot be known. Much less therefore can the essence of God be seen through any created

species whatever. Per similitudines inferioris ordinis rerum nullo modo superiora possunt cognosci: sicut per speciem corporis non potest cognosci essentia rei incorporeae. Multo igitur minus per speciem creatam quamcumque potest essentia Dei videri. *Summa Theologiae*, q. 12, a. 2. English translation by Pegis.

<sup>30</sup> God is more distant from creatures than any creatures are from each other. Deus plus distat a creaturis quam quaecumque creaturae ab invicem. *Summa Theologiae*, q. 13, a. 5. English translation by Pegis.

<sup>31</sup> See footnote note 9.

<sup>32</sup> See *De Caelo et Mundo*, II. I. iv, n 332.

<sup>33</sup> Intellectus vix per huiusmodi exteriora potest ad perfectam notitiam inferioris naturae pervenire, etiam illarum rerum quarum accidentia sensu perfecte comprehendit. Multo igitur minus pertingere poterit ad comprehendendum naturas illarum rerum quarum pauca accidentia capimus sensu; et adhuc minus illorum quorum accidentia sensu capi non possunt, etsi per quosdam deficientes effectus percipiantur. *Summa Contra Gentiles*, IV, cap. 1, n.3340. English translation by Pegis, Anderson, Bourke and O'Neal, in *The Pocket Aquinas*, p.318-319.

<sup>34</sup> *Posterior Analytics*, Book II, ch. 8, 93a, 27-28. In *The Basics Works of Aristotle*.

<sup>35</sup> *Posterior Analytics*, Book II, ch. 8, 93a, 24-26. In *The Basics Works of Aristotle*.

<sup>36</sup> See footnote note 26.

<sup>37</sup> The other [type of explanation] lays down an hypothesis and shows that the observed effects are in accord with the supposition, as when astronomy employs a system of eccentrics and epicycles to justify our observations about the motions of the heavenly bodies. It does not carry complete conviction, because other hypotheses might also serve. Alio modo inducitur ratio, non quae sufficienter probet radicem, sed quae radici iam positae ostendat congruere consequentes effectus, sicut in astrologia ponitur ratio excentricorum et epicyclorum ex hoc quod, hac positione facta, possunt salvari apparentia sensibilia circa motus caelestes. Non tamen ratio haec est sufficienter probans, quia forte etiam alia positione facta salvari possent. English translation by Gilby. Aquinas also writes that, "From an effect, which can proceed from several causes, one of them cannot be concluded." Nam ab effectu, qui a pluribus causis procedere potest, non potest una illarum concludi. In *Posteriorum Analyticorum*, L. I, l. xxiii, n.199. English by Larcher.

<sup>38</sup> See footnotes 60 and 61 of the previous chapter for the passages from the *De Trinitate*, q. 5, a. 4. In the *Treatise on Separate Substances* Aquinas says he will accept whatever the philosophers have said about the angels which is in agreement with the scriptures. Aquinas is forced to rely on the scriptures because it is impossible for the unaided intellect to study the nature of angels directly for itself.

<sup>39</sup> See footnote n. 4.

<sup>40</sup> A good example of this principle at work in the sciences can be found in Aristotle's discussion of the nature of growth. He says that a 'true' understanding of the nature of growth must 'preserve whatever belongs to the notion of the thing in question and exclude all impossibilities'. Oportet autem quod vera solutio salvet omnia quae sunt de ratione rei, et omnia impossibilia excludat. The discussion then opens with a list of all the essential components of growth which the solution must incorporate, as well as a list of 'impossible' consequences the solution must avoid. *De Generatione et Corruptione*, L. I, l. xv, n. 104.

<sup>41</sup> In *De Trinitate*, q. 2, a. 3, Aquinas outlines how philosophy can be of service to theology. The most important for our purposes is that philosophy can be used to refute assertions contrary to the faith by, a) showing the contrary assertions to be false, or b) showing that they lack necessity. It is understood that the articles of faith cannot be established conclusively; the best one can hope for it to show that one's position is not impossible.

<sup>42</sup> A good example of this procedure can be found in Aristotle's discussion of the appearance of the Milky Way. Some held that the bright milky appearance is caused by the star's own light which we can see from the earth because the earth's shadow blocks out the sun's light which would otherwise render the star's light imperceptible. This theory is rejected in the following manner: 'If the cause of the milky brightness' visibility were the earth's shadow blotting out the stars, then as the sun moved, the milky brightness would also have to shift. But this is not seen to happen, because it

always appears in the same place and in the same stars. . . .Consequently the aforesaid theory is false.' Si igitur occultatio stellarum per umbram terrae esset causa apparitionis lacteae claritatis, oporteret, moto sole, transferri et lacteam claritatem. Sed hoc non videtur fieri, quia semper apparet in eodem loco et in eisdem stellis, ut dictum est. Falsa est igitur praedicta opinio. *Meteorologicorum*, L. 1, l. xii, n.81. English translation by Larcher and Conway.

<sup>43</sup> In *De Aeternitate Mundi* Aquinas poses two questions: a) have the philosophers really proved the thesis that the world is eternal? and b) have the theologians really proved with certainty that the universe had a beginning in time? Aquinas concludes, first, that there are no proofs of the eternity of the world, simply suasive arguments; and second, that reason can prove that the world is created, but not that it is created in time. He states that an eternal, yet created, universe is not a logical contradiction.

<sup>44</sup> Sacred Scriptures, since it has no science above itself, disputes argumentatively with one who denies its principles only if the opponent admits some at least of the truths obtained through divine revelation. Thus, we can argue with heretics from texts in Holy Scripture, and against those who deny one article of faith we can argue from another. If our opponent believes nothing of divine revelation, there is no longer any means of proving the articles of faith by argument, but only of answering his objections - if he has any - against faith. Unde sacra Scriptura, cum non habeat superiorem, disputat cum negante sua principia, argumentando quidem si adversarius aliquid concedat eorum quae per divinam revelationem habentur; sicut per auctoritates sacrae doctrinae disputamus contra haereticos, et per unum articulum contra negantes alium. Si vero adversarius nihil credat eorum quae divinitus revelantur, non remanet amplius via ad probandum articulos fidei per rationem, sed ad solvendum rationes, si quas inducit, contra fidem. *Summa Theologiae*, q. 1, a. 8. English translation by Pegis.

<sup>45</sup> Si autem dicatur quod est possibile esse aliquam talem speculativam scientiam quamvis adhuc non sit inventa, hoc nihil est: Quia non est possibile per aliqua principia nobis nota ad intelligendas substantias praedictas devenire. Omnia enim propria principia cuiuscumque scientiae dependent ex principiis primis indemonstrabilibus per se notis, quorum congitionem a sensibilibus accipimus. *Summa Contra Gentiles*, III, cap. 41, n. 2190. English translation by Thomas Gilby and found in *St. Thomas Aquinas: Philosophical Texts*. London: Oxford University Press, 1951.

<sup>46</sup> Vanum enim est quod est ad finem quem non potest consequi. *Summa Contra Gentiles*, III, cap. 44, n. 2213. English translation by Gilby.

## **Part III**

### ***Illustrations and Conclusions***

In Part II we were faced with two particular tasks. First, it was necessary to familiarise ourselves with the Aristotelio-Thomistic scientific project in general, and with the divisions of the speculative sciences in particular (our interest in this project being the direct result of the investigations carried out in Part I). We then went on to consider the cognitive status of natural science and theology. Now, in the third and concluding part of this study, we return to the realist dispute in science armed with the intellectual apparatus of Aquinas.

The similarities between his intellectual project and our own have lead us to think that Aquinas' philosophy of science will be of interest to us. His desire to reconcile two distinct and apparently contradictory intellectual and religious traditions, each seen to be offering something of value, mirrors our attempt to synthesise realist and anti-realist views in the philosophy of science. His methodological pluralism, and his willingness to match his cognitive expectations to his subject matter also matches our willingness to confine our truth-talk to specific theories while recognising that other theories are 'merely' empirically adequate. Just as important, we found that we share a common demarcation of realms. Our distinction between objects whose linguistic counter-part crosses translation determinately and those that do not tracks his distinction between material/sensible and immaterial/non-sensible substances. Moreover, Aquinas does not think that theologians are simply 'playing a different language game' from scientists, each having their own incommensurable rules and standards to govern their work. Aquinas wanted to make theology into a strict Aristotelian science, and consequently, as a theologian, he was bound by the rules of scientific procedure. Consequently his theology and natural science are seen as parts of a over-arching intellectual project, not as distinct and incommensurable language games. Finally, what we find in Aquinas is a picture of what a realistically interpretable theory might look like, as well as a method for the treatment of theories and entities not amenable to realist interpretation.

It is the application of Aquinas' intellectual system which is now our primary concern. Given the amount of space with which we have to work, we will apply the apparatus to only two modern scientific theories by way of illustration. Then we can review the list of difficulties encountered by scientific realism and anti-realism discussed in the *Introduction* to Part I to see whether our synthesis of the two interpretative traditions is able to cope with these difficulties.

### *Applications*

The first lesson of Part II is that modern scientific theories often contain statements an Aristotelian would consider as belonging to distinct speculative sciences. Indeed, one schooled in Aristotelian science cannot help but notice that modern science ignores, or blurs, the distinctions recognised by Aquinas between physics, metaphysics and theology. What I propose is that we use the divisions of the speculative sciences found in Aristotle and Aquinas as a grid or map on which to place the various theories developed by modern science. In so doing we regain our sensitivity to the cognitively distinct components of modern scientific theories.

The following Tables will make our points easier to appreciate. The first table sums up the material of Part II, while the *Table of the Sciences*, their intelligible objects, cognitive status, and the relation that obtains between those objects gained via abstraction and whose linguistic counter-part cross translation, will serve as a standard against which modern theories can be viewed. The important point to note is that terms occurring in modern scientific theories referring to entities requiring anti-realist treatment are grouped with the terms 'God' and 'Angels'. The essential features to note are the following: An anti-realist approach is adopted vis à vis any sentence containing categorematic terms referring to individuals whose linguistic counter-part *does not* cross translation determinately. Conversely, sentences taken realistically are those whose categorematic terms refer to individuals whose linguistic counter-part *does* cross translation determinately. This difference with respect to translation has cognitive significance

precisely because categorematic terms not crossing translation refer to intelligible objects not gained via abstraction. On the other hand, a realist approach can be adopted vis à vis those sentences containing categorematic terms which cross translation because such terms refer to individuals upon which the operation of abstraction can be performed. Here we have a dove-tailing of a modern, linguistic criterion with a classical epistemological theory. Moreover, when we look at two modern scientific theories we will also see that realistically interpretable theories are those which provide not only the 'that' (*quia*), but also the 'how' or 'why' (*propter quid*); anti-realist theories, on the other hand, are restricted to accurately presenting the 'that'.

### **The Three Degrees of Abstraction**

<i>Name</i>	<i>Type of Matter</i>	<i>Intelligible Object</i>	<i>Science</i>
First Degree: ( <i>Abstractio totius</i> )	Sensible Individual matter -The Universal is abstracted from the Particular	-Natural Kinds: Individuals of specific kinds in matter and motion - Elements, Plants and Animals	Physics
Second Degree: ( <i>Abstractio formae</i> )	-Common Sensible matter & Individual Intelligible matter	-Mathematicals: Quantifiable aspects of Concrete individuals - Points, Lines, Planes, Figures and Numbers	Mathematics
Third Degree: (First abstraction in the second act of the intellect)	-All matter -The act of existing is abstracted from the essence of the concrete individual.	-Transcendentals: Those features all existing things have in virtue of the fact that they exist - Substance, Potentiality, Actuality,	Metaphysics Proper



## Table of the Sciences

	<i>Thomist Science</i>	<i>Questions Treated</i>	<i>Demarcation mechanism</i>	<i>Epistemo- logical Distinction</i>	<i>Typical Individuals and Terms</i>
<b>Anti- Realism</b>	Theology	An est? Quia?	Terms not crossing translation	Intelligible Objects are not gained via abstraction	God; Angels; Atoms and sub-atomic particles; Force Fields (gravitation, electro- magnetic); Energy; Space/Time
<b>Realism</b>	-Metaphysics (Proper) -Mathematics -Intermediate Sciences -Physics (Natural Sciences)	-An est? -Quia? -Quid est? -Propter quid?	Terms crossing translation	Intelligible Objects are gained via abstraction	Terms for Natural Kinds: Cow; Chicken; Beetle; Baobab; Sulphur; Copper

### *Darwin and Newton - Illustrations*

Let us now apply this grid to two well known scientific theories: Darwin's theory of Natural Selection, and Newton's Laws of Motion and Gravity. The theory of natural selection will serve as our paradigm case of a realistically interpretable theory, the reason being that no categorematic terms in his theory refer to entities above the dividing line between theology and the other speculative sciences. Darwin's theory is

about the nature of certain kinds of individuals accessible to sense observation, and the processes these individuals undergo. The descriptive component of the theory is limited to an account of the biological structures of plants and animals. The explanatory component of the theory, the process of natural selection, explains how these particular structures have descended from the previous generations. Modifying Calvin<sup>1</sup>, we can state the six essentials of 'a Darwinian process' to be the following:

1) Ontologically the Darwinian is committed to the existence of certain kinds of individuals, viz., biological organisms, and the organic and non-organic elements found in their environment. Furthermore, the biological organisms are of a particular *nature, kind, or species*. (We need not discuss at this point whether Aristotelian natural kinds match up precisely with Darwinian species, or whether modern biology is superficially or profoundly Aristotelian. What is important is that both Aristotle and Darwin are dealing with the same kinds of individuals encountered in the realm of the Real accessible to sense experience, and both would agree that these individuals are members of some class of things. This is enough for our present purposes. Moreover, I ought to repeat, I am not interested in defending any particular theories; I merely want to interpret what has been put forward by scientists for our consideration.)

2) These individuals are capable of reproducing, or bringing into being, other individuals of the same kind or species.

3) While all individuals resemble those that brought them into being insofar as they are of the same species, no two individuals are identical. Individuals are *variations* on the basic biological structure of natural kinds. Nonetheless, deviations from the basic structure are passed from 'parents' to 'offspring'.

4) The variations compete for a limited set of resources (food, shelter, mates, etc.).

5) The relative success of a variation is influenced by a multi-faceted

environment. Those variations best suited to the prevailing conditions tend to have more offspring than those which are less well adapted.

6) The process has a 'loop'. The next generation, or reproductions of the original biological structure, is based on which variations of the last generation survived to maturity.

Now I would argue that no ostensibly referential term in this theory refers to an individual whose linguistic counter-part fails to cross translation determinately. Terms like 'cow', 'chicken', 'chimpanzee', 'baobab', 'beetle', etc. can all serve in the occasion sentences of our intrepid anthropologist; and each refers to a group of individuals upon which the process of intellectual abstraction can be performed. The essential component of Darwin's theory is his account of how the individuals named by such terms interact with each other and their environment, and the consequences of these relationships on the natural history of the particular species. 'Natural selection' is, of course, not an individual, but a short hand way of referring to the competition of organic individuals for limited resources. So Darwin's theory states certain facts, *that* organisms of various kinds exist, and *that* the biological structure of these kinds changes over time, as well as explaining the *mechanism*, the 'how' or 'why', by which the above facts come about: this particular variation of a species flourishes in such and such an area *because* it is particularly well adapted to the conditions found here. The less well adapted variations of the species were not as successful in reproducing individuals like themselves. This interpretation of Darwin's theory does not suffer from the fact that *other* factors might also play a part in the natural history of species. Stephen Gould, and those championing 'lottery biology', suggests that luck has as much to do with which species avoid extinction as the forces of natural selection. But this is an addition to Darwin's theory, not a refutation of it.

Compare this theory with that of Newton's Laws of Motion and Gravity. Newton states that:

1) A body not acted on by a *force* continues in a state of rest, or

uniform motion in a straight line.

2) **Force equals mass times acceleration.**

3) To every **action force** there is an equal and opposite **reaction force**.

4) Between any two bodies there is a **force of attraction** proportional to the product of their **masses** divided by the distance between them squared.

The highlighted terms are incapable of serving in occasion sentences in the opening stages of the our anthropologist's efforts at radical translation, as Quine's remarks about theoretical terms would lead us to expect. As such they find themselves above the dividing line between theology and the other speculative science. The meanings of the terms 'force' and 'mass' are fixed by the equation presented in (2) ('acceleration' we can allow as a quantifiable feature of bodies in motion) and the meaning of 'force of attraction' is fixed by the formula presented in (4). None will cross translation determinately; these are terms for theoretical constructs which serve as tools in the derivation of observation sentences from other observation sentences. This assessment is also born out by the history of our understanding of gravitation. While everyone agrees that material bodies tend to move towards each other, and that this movement can be described mathematically very accurately, there is little agreement on the matter of *how* this movement is produced. The Aristotelian notion that concrete particulars have an inherent tendency to move to their natural place in the cosmos has long since been abandoned; but Newton's idea of action at a distance brought about by a force of attraction is no less mysterious, as was pointed out by many of his contemporaries. Many regarded his theory as 'a lapse into old heresies which had attributed something like occult properties to matter'.<sup>2</sup> Newton himself is unclear on just what he makes of this notion of gravitation. Butterfield gives the following account of this confusion:

[Newton] denied that he had committed himself to any explanation of gravity, or to anything more than a

mathematical description of the relations which had been found to exist between bodies of matter. At one moment, however, he seemed privately to favour the view that the cause of gravity was in the ether (which became less dense at or near the earth, and least dense of all at or near the sun), gravity representing the tendency of all bodies to move to the place where the ether was rarer. At another time he seemed to think that this gravitation of his represented an effect that had to be produced by God throughout the whole of space - something that made the existence of God logically necessary. . . .<sup>3</sup>

But those who favoured an anti-realist reading of the theory, dismissed the concern over the cause of gravitation as unimportant. Consider these lines from Diderot's *Encyclopédie*:

. . . Il est facile de juger combien sont injustes ceux des philosophes modernes qui se déclarent hautement contre le principe de l'attraction, sans apporter d'autres raisons, sinon, qu'ils ne conçoivent pas comment un corps peut agir sur un autre qui en est éloigné . . . . Rien n'est plus sage et plus conforme à la vraie philosophie, que de suspendre notre jugement sur la nature de la force qui produit ces effets. Partout où il y a un effet, nous pouvons conclure qu'il y a une cause, soit que nous la voyons ou que nous ne la voyions pas. Mais quand la cause est inconnue, nous pouvons considérer simplement l'effet sans avoir égard à la cause. . . . *Les phénomènes de l'attraction* sont la matière des recherches physiques; et en cette qualité ils doivent faire partie d'un système de physique : mais *la cause de ces phénomènes* n'est du ressort du physicien, que quand elle est sensible, c'est à dire quand elle paraît elle-même l'effet de quelque cause plus relevée. . . . Ainsi nous pouvons supposer autant de cause d'attraction qu'il nous plaira, sans que cela puisse nuire aux effets.<sup>4</sup>

Subsequent developments in the theory of gravitation include reference to 'force fields', 'gravitational waves', or 'stresses' radiating out from bodies and influencing other bodies through this medium. But this is no place for an examination of the various theories of gravity on offer. The significant point for us is that 'gravity', as understood by Newton, is not a term which can serve in an occasion sentence, and hence must be placed above the dividing line between theology and the other

speculative sciences. The evidence from the history of science is called on simply to point out the fact that this history is consistent with our view that 'gravity' is a theoretical construct which must be interpreted anti-realistically. But this is not to say that gravity does not exist. We are only committed to saying that an understanding of the nature of gravity is bound to elude us. And this brings out a further distinction between the theories of Newton and Darwin. While Newton's theory of motion and gravity is able to account for the facts on the ground, unlike Darwin's theory, it is unable to explain the nature of the cause; in the terminology we have been employing, Newton provides the 'that' (*quia*) but not the 'why' or 'how' (*propter quid*). It is in this regard that Newton's theory of Gravitation is comparable to Aquinas' treatment of the nature of God.

There is insufficient space to allow us to consider other theories in any detail. Nevertheless, it is worth our while to list a number of terms commonly used in modern theories which will have to be given an anti-realist reading according to our stated position. All sentences containing the terms 'atom' (and sub-atomic parts); 'space'; 'time'; 'rays' or 'radiation' (gamma rays, x-rays, visible light, infrared, radio waves); 'force fields' (mechanical, electro-magnetic, gravitational); 'heat'; 'energy' must be treated anti-realistically. Again it must be insisted upon that our version of anti-realism does not deny that such things exist, anymore than Aquinas would say that God does not exist. But more of this shortly.

### *The Problems of Part I Revisited*

Let us now return to the set of problems identified in the *Introduction* to this work. We will recall that scientific realism and scientific anti-realism each faced a set of objections when taken in isolation. Now we must see how our synthesised position fares with regard to these particular problems.

### *The Problem of Consistent Interpretation*

It was argued against the naive realist that a consistent realist interpretation of all scientific theories was difficult if not impossible to provide. This problem dissolves as soon as naive realism is abandoned in favour of moderate realism. The moderate realist insists only that *some* of the terms in scientific theories are candidates for realist interpretation, while others require an anti-realist approach. The problem is then one of identification: Which theories are we to take realistically? It is also worth noting that some of the pressing contradictions between scientific theories, for example, on the nature of time in Quantum mechanics and Relativity, concern terms which must be taken anti-realistically according to us. This does not mean that the endeavour to overcome this contradiction, i.e., to proceed *as though* 'time' were to be taken realistically, is not worth pursuing. The heuristic value of such an attempt could be enormous.

### *Defining Theoretical Terms*

It will be recalled that the particular difficulty here was to give a semantic account of theoretical terms consistent with a realist interpretation. We stated at the outset that the semantics of theoretical terms pose a problem only in this sense. But if one is no longer a realist about *all* theoretical terms, the tension dissolves. We can use any semantic theory which seems appropriate in the given circumstances, and adopt the appropriate interpretative approach without contradicting ourselves.

### *The Blurring of the Theory/Observation Dichotomy*

This is a problem shared by both the scientific realist and anti-realist. We have accepted that there is no absolutely theory-free observation language. But what our Thomistic anti-realist has done is shift the focus away from the now unserviceable theory/observation dichotomy, onto the distinction between a species-specific conceptual scheme and

local, or parochial, conceptual schemes. All conceptual schemes are human constructs; but our Thomistic anti-realist argues that some aspects of our conceptual schemes enjoy a particular status, viz., they are found in all conceptual schemes. This distinction is able to do the work hitherto performed by the theory/observation dichotomy, without falling prey to the weakness of the latter. So while we can agree that all observation is theory-laden, we do not need to accept that all observations are equally 'subjective'. Indeed the virtue of having a species specific conceptual scheme is precisely that undue or excessive subjectivism, irrationalism or relativism is avoided without exposing oneself to the charge of unwarranted and pernicious dogmatism.

### *Truth-talk and the Under Determination of Theory by Data*

Naive scientific realism states that the aim of science is the discovery of the One True theory of the Real. But we saw in the *Introduction* that we have good reason to believe that we cannot verify or falsify any given theory. Consequently, even if we were to stumble across the One True theory we would not be able to recognise it as such (although it is likely that we could recognise its heuristic value). Now given that the aim of the scientific realist is unattainable, it is prudent that we alter our understanding of the scientific project. This is what has been done by our moderate realist, or Thomistic anti-realist, who is striving to attain a more complete inventory of the Real *as it presents itself to us*. Our realist insists only that some terms in our theories actually refer to extra-linguistic entities which are cognitively accessible to us, and that we can form true statements about these. Concerning all other terms an anti-realist approach is necessary. Our realist does not say, however, that he has over-come the logical difficulties posed by Induction or the logic of verification or falsification. He states simply that the existence of some entities does not require demonstration via inference from effects. Of these a realist attitude can be taken, *because it is the manner in which we know that something exists which determines the interpretative stance to be adopted*, not whether we can or cannot verify or falsify a theory.



### *The Results of Historical Research*

The naive realist could adopt various positions on the nature of scientific development, most of which have taken a serious drubbing at the hands of historical researchers. In particular it has been suggested that scientific development is 'revolutionary' as opposed to 'evolutionary' and 'accumulative', and that there is an element of subjectivity in the abandoning of one theory in favour of another. These results do not surprise or embarrass our synthetic position, but we must qualify what we say in the following manner. Admittedly there is no reason to assume that science is progressing towards, or converging upon, the One True theory of the Real. Our moderate realist must accept that there is no scientific progress in this sense. But there is an undeniable increase in our knowledge of the world accessible to sense experience. Indeed, this is precisely what our moderate realist, or Thomistic anti-realist, is striving to attain. And it is vital that we recognise that theory has an indispensable part to play in this process. As stated earlier, the best scientific theories are heuristic devices as well as tools for the derivation of observation sentences from other observation sentences. Their heuristic value lies in the fact that they can lead the scientist to notice much which has hitherto been unobserved, but which is not in itself unobservable.

There is an important consequence of this which we cannot ignore. If the Thomistic anti-realist accepts that the goal of the scientific enterprise is precisely the more and more complete inventory of the Real as it presents itself to us, then there can be a fully rational motivation for choosing one theory over another *even if both are taken anti-realistically*, viz., its heuristic value. I would argue that it was perfectly rational for the scientific community to back Newton rather than Descartes, despite the fact that Descartes' theories were never refuted by experiment, and despite the fact that we are anti-realists with respect to Newtonian mechanics. As has been pointed out, the demise of Cartesian science was brought about, at least in part, by its failure to lead researchers to any interesting discoveries, i.e., it was not heuristically powerful.<sup>5</sup> Now, given our understanding of the scientific enterprise, this is as good a reason for abandoning a theory as one could ask for. Consequently, Lakatos' worry<sup>6</sup> that we are faced with a

stark choice between Popper's 'cavalier' Methodological Falsificationism on the one hand, and Irrationalism on the other, is not entirely well founded. One can have a fully rational motivation for setting aside one theory in favour of another despite the fact that we can never conclusively verify or falsify a given theory.

### *The Ultimate Objection*

We saw that it is difficult for the anti-realist to explain how a theory which is not taken to be true can at the same time serve as a tool in the derivation of observation sentences from other observation sentences. An answer to this question can be provided by our Thomistic anti-realist. The Thomistic anti-realist does not deny that terms for theoretical entities refer to something real. In the same way that Aquinas would clearly not deny that the term 'God' refers to some real entity, we too need not deny that 'force field', for example, refers to something real. Since theoretical terms are taken to refer to the cause of certain observable phenomena (this being part of the signification of such terms), and insofar as we are willing to state that all effects have a cause, or set of causes, we can quite consistently say that the causes referred to by the theoretical terms exist. But what our Thomistic anti-realist denies is that we can ever establish anything about the essential nature of these causes. Consequently, the nature *we assign* to our theoretical entities cannot be taken as a literal description of the nature of the cause in itself. But what successful theories do get right is the fact that there is something, or somethings, which *fulfil the role* of the entity referred to by the theoretical term as used in the successful theory. This is why the theory can serve as a useful tool for the derivation of observation sentences from other observation sentences. It is in this sense that we can say *that* the entities referred to by theoretical term exist, but that we do not know *what* they are. Such a reading of theories allows our Thomistic anti-realist to account for two clearly recognised facts in the history of science: first, that many theories are developed, enjoy their time under the sun, and then leave the scene; and second, that despite their eventual passing, they are nevertheless often highly useful, both as instruments of prediction and

as heuristic devices. They are useful because they in fact latch on to something real; they come and go because they cannot establish the nature of the Real they have latched onto.

### *Summary*

Let us sum up what we have accomplished in this study. It seems that we have done justice to the best aspects of both scientific realism and scientific anti-realism while avoiding their respective weaknesses. Indeed, each position has provided the corrective needed by the other. In this sense at least we have been well guided by Aristotle who taught that it is not probable that the views held by many eminent persons 'should be entirely mistaken. . . , but rather that they should be right in at least some one respect or even in most respects'.<sup>7</sup> And we have succeeded in assigning each interpretative attitude its proper domain without being driven into irrationalism or dogmatism. This is of no small moment considering the point of departure of this study. We began by noting the fact that the natural sciences have had, and continue to have, a considerable influence on the wider social and intellectual community, despite the fact (or because of the fact?) that the majority of our contemporaries are scientifically illiterate (and philosophically illiterate about science). Thankfully, modern science is here to stay; yet it is precisely because of its extraordinary success in certain fields that we are always open to the danger Montaigne spotted long ago: that what ought to be a highly prized cultural and intellectual achievement should become an object of reverence and adoration.<sup>8</sup> But if 'bowing at the alter of science' is uncalled for, so too is the unqualified condemnation and disparagement of our scientific heritage.

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<sup>1</sup> William Calvin. "How To Think What No One Has Ever Thought Before", in *How Things Are*. Edited by Brockman and Matson. Great Britain: Weidenfeld and Nicolson, 1995.

<sup>2</sup> Herbert Butterfield. *The Origins of Modern Science*. London: Bell and Hyman, 1982, p. 157.

<sup>3</sup> *Ibid.*, p. 157.

<sup>4</sup> D'Alembert. "Attraction", in Diderot's *Encyclopédie*, extracts. Edited by J. and M. Charpentier. Paris: Bordas, 1985, p. 46.

<sup>5</sup> Jim Edwards. *Philosophy of Science*. Course text book, p. 39.

<sup>6</sup> Imre Lakatos. "Falsification and the Methodology of Research Programmes", in *Can Theories Be Refuted?* Ed. Sandra Harding. Boston: D. Reidel Publishing Co., 1976, pp. 223-4.

<sup>7</sup> *Nicomachean Ethics*, B. I, Ch. 8, 1098b, 25-30. Translation by W. D. Ross, in *The Basic Works of Aristotle*, ed. McKeon. New York: Random House, 1941.

<sup>8</sup> Michel de Montaigne. "Apologie de Raimond Sebond", in *Essais, Livre 2*. Paris: Garnier-Flammarion, 1979, p. 105.

## Bibliography

### **Philosophical Works:**

Alexander, P. *Sensationalism and Scientific Explanation*. London: Routledge & Kegan Paul, 1963.

Appiah, A. *For Truth in Semantics*. Oxford: Blackwell, 1986.

Ardley, G. *Aquinas and Kant: The Foundations of the Modern Sciences*. Toronto: Longmans, Green & Co., 1950.

Bridgeman, P. W. *The Logic of Modern Physics*. New York: MacMillan Co., 1927.

Calvin, W. How To Think What No One Has Thought Before. In *How Things Are*. Edited by Brockman and Matson. Great Britain: Weidenfeld and Nicolson, 1995.

Cartwright, N. *How the Laws of Physics Lie*. New York: Oxford University Press, 1990.

Davidson, D. *Inquiries into Truth and Interpretation*. Oxford: Clarendon Press, 1984.

Davidson, D. and Hintikka, J. eds. *Words And Objections*. Boston: D. Reidel Publishing Co., 1975.

Dilthey, W. *Selected Works. Vol. 1, Introduction to the Human Sciences*. Edited and translated by Makkreel and Rodi. Princeton: Princeton University Press, 1989.

Duhem, P. *The Aim and Structure of Physical Theory*. Translated from the second ed. by Wiener. Princeton: Princeton University Press, 1954.

-----*To Save the Phenomena*. Chicago: University of Chicago Press, 1969.

Dummett, M. *Frege: Philosophy of Language*. Second Ed. London: Duckworth, 1981.

-----*The Logical Basis of Metaphysics*. Cambridge, Mass.: Harvard University Press, 1991.

-----*Truth and Other Enigmas*. London: Duckworth, 1992.

Eddington, A. *The Philosophy of the Physical Sciences*. London: Cambridge University Press, 1939.

Edwards, J. Debates about Realism Transposed to a New Key. In *Mind*, Vol. 103.409, Jan. 1994.

-----*The Philosophy of Science*. Course book at the University of Glasgow, 1996.

Evans, G. and McDowell, J. *Truth and Meaning: Essays in Semantics*. Oxford: Clarendon Press, 1976.

Evans, G. Identity and Predication. In *The Journal of Philosophy*, vol. 72, 1975.

Fackenheim, E. *God's Presence in History*. New York: N.Y.U. Press, 1970.

Feyerabend, P. *Against Method*. Revised Ed. London: Verso, 1988.

-----*Science in a Free Society*. London: Verso, 1982.

Field, H. *Science Without Numbers: A Defence of Nominalism*. Oxford: Basil Blackwell, 1980.

-----*Realism, Mathematics and Modality*. Oxford: Basil Blackwell, 1989.

Grandy, R. *Theories and Observations in Science*. New Jersey: Prentice Hall Inc., 1973.

Hacking, I. *Representing and Intervening: Introductory Topics in the Philosophy of Natural Science*. Cambridge: Cambridge University Press, 1983.

Haldane, J. Ontological and Epistemological Realism in Aquinas. To appear in *Realism and Reason*.

Harding, S. ed. *Can Theories Be Refuted? Essays on the Duhem-Quine Thesis*. Dordrecht: D. Reidel Publishing Co., 1976.

Harré, R. *The Philosophies of Science*. London: Oxford University Press, 1972.

Heisenberg, W. *Physics and Philosophy*. London: George Allen and UncoIn Ltd., 1958.

Hempel, C. *Philosophy of Natural Science*. New Jersey: Prentice-Hall, Inc., 1966.

Kant, I. *Critique of Pure Reason*. Translation by Norman Kemp Smith. New York: St Martin's Press, 1965.

Kuhn, T. *The Structure of Scientific Revolutions*. Second Ed. Enlarged. Chicago: University of Chicago Press, 1970.

Lakatos, I. Changes in the Problem of Inductive Logic. In *The problem of inductive logic: Proceedings of the International Colloquium in the Philosophy of Science*. Edited by Lakatos. Amsterdam: North-Holland, 1968.

McGinn, C. Truth and Use. In *Reference, truth and reality: essays in the philosophy of language*. Edited by Platts. London: Routledge & Kegan Paul, 1980.

-----Reply to Tennant. In *Analysis*, vol. 41, 1981.

Mermin, N. Quantum Mysteries for Anyone. In *Journal of Philosophy*, vol. 78, 1981.

Nagel, E. *The Structure of Science: Problems in the Logic of Explanation*. Indianapolis: Hackett Publishing Co., 1979.

Pasachoff, J.M. *Contemporary Astronomy*. Third ed. Philadelphia: Saunders College Publishing, 1985.

Peirce, C. *Philosophical Writings of Peirce*. Ed. Justus Buchler. New York: Dover Publications, 1955.

Poincaré, H. *Science and Method*. Bristol: Thoemmes Press, 1996.

Popper, K. *The Logic of Scientific Discovery*. London: Unwin Hymanm, 1980.

Prior, A. The runabout inference Ticket. In *Analysis*, vol. 24, 1963.

-----Conjunction and Contonktion Revisited. In *Analysis*, vol. 24, 1964.

Putnam, H. *Realism and Reason*. Cambridge: Cambridge University Press, 1983.

-----*Meaning and the Moral Sciences*. London: Routledge & Kegan Paul, 1978.

-----*Philosophy of Logic*. London: Allen and Unwin, ?

-----*Reason, Truth and History*. Cambridge: Cambridge University Press, 1981.

Quine, W.V. *From a Logical Point of View*. Second Edition, Revised. Cambridge, Mass.: Harvard University Press, 1980.

-----*Ontological Relativity and Other Essays*. New York: Columbia University Press, 1969.

-----*Philosophy of Logic*. Second Edition. Cambridge, Mass.: Harvard University Press, 1986.

-----*Pursuit of Truth*. Cambridge, Mass.: Harvard University Press, 1990.

-----*Word And Object*. Cambridge, Mass.: MIT Press, 1960.

Ramsey, F.P. *Philosophical Papers*. Cambridge: Cambridge University Press, 1990.

Sahlin, N.E. *The Philosophy of F.P. Ramsey*. Cambridge: Cambridge University Press, 1990.

Smith and Jones. *The Philosophy of Mind*. Cambridge: Cambridge University Press, 1986.

Smolin, L. What is Time? In *How Things Are*. Edited by Brockman and Matson. Great Britain: Weidenfeld and Nicolson, 1995.

Strawson, P.F. *Individuals: An Essay in Descriptive Metaphysics*. London: Methuen & Co., 1959.

-----*Introduction to Logical Theory*. London: Methuen & Co., 1952.

Tennant, N. *Anti-Realism and Logic*. Oxford: Clarendon Press, 1987.

-----Is this a proof I see before me? In *Analysis*, vol. 41, 1981.

-----Were those disproofs I saw before me? In *Analysis*, vol. 44, 1984.

-----Weir and those 'disproofs' I saw before me. In *Analysis*, vol. 45, 1985.

Van Fraassen, B. *The Scientific Image*. Oxford: Clarendon Press, 1980.

Weir, A. Truth Conditions and Truth Values. In *Analysis*, vol. 43, 1983.

-----Reply to Tennant. In *Analysis*, vol. 45, 1985.

Wiggins, D. *Sameness and Substance*. Oxford: Basil Blackwell, 1980.

Wright, C. *Truth and Objectivity*. Cambridge, Mass.: Harvard University Press, 1992.



***Histories by Modern Authors:***

Blumenburg, H. *The Genesis of the Copernican World*. Translated by R. M. Wallace. Cambridge, Mass.: The MIT Press, 1987.

-----*The Legitemacy of the Modern Age*. Translation by R.M. Wallace. Cambridge, Mass.: The MIT Press, 1983.

Butterfield, H. *The Origins of Modern Science*. Second Ed. New York: MacMillan Co., 1957.

Cohen, I.B. *The Birth of a New Physics*. Revised Ed. New York: W.W. Norton & Co., 1985.

Crombie, A.C. Grossteste's Position in the History of Science. In *Robert Grossteste*. Edited by Callus. Oxford: Clarendon Press, 1955.

Dales, R.C. *The Scientific Achievement of the Middle Ages*. Philadelphia: University of Pennsylvania Press, 1973.

Duhem, P. *Etudes Sur Leonardo de Vinci*. Vol. 1-3. Paris: F. De Nobeles Librairie, 1955.

-----*Le Système du Monde*, Vol. 2. Paris: Librairie Scientifique Hermann et Co., 1954.

Einstein and Infeld. *The Evolution of Physics*. Cambridge: Cambridge University Press, 1947.

Foster, M.B. The Christian Doctrine of Creation and the Rise of Modern Science. In *Mind*, vol. 43, 1934, pp. 446-468.

Grant, E. *Physical Science in the Middle Ages*. New York: John Wiley & Sons, Inc., 1971.

Hooykaas, R. *Religion and the Rise of Modern Science*. Edinburgh: Scottish Academics Press, 1972.

Kirk, Raven and Schofield. *The Presocratic Philosophers*. Second Edition. Cambridge: Cambridge University Press, 1991.

Koyré, A. The Origins of Modern Science. In *Diogenes*, XVI, 1956, pp. 1-22.

Lindberg, D. Editor. *Science in the Middle Ages*. Chicago: University of Chicago Press, 1978.

Neugebauer, O. *The Exact Sciences in Antiquity*. Second Ed. New York: Dover Publications, 1969.

Randall, J.H. Jn. The Place of Leonardo Da Vinci in the Emergence of Modern Science. In the *Journal of the History of Ideas*, Vol. 14, pp. 191-202.

Thorndyke, Lynn. *History of Magic and Experimental Science. Vol. 1, The First Thirteen Centuries.* New York: Columbia University Press, 1923.

Van Riper, A.B. *Men Among the Mammoths: Victorian Science and the Discovery of Human Prehistory.* Chicago: University of Chicago Press, 1993.

Whitehead, A. *Science and the Modern World.* Cambridge: Cambridge University Press, 1932.

### **Works in Latin by Aquinas:**

*De Ente et Essentia.* Romae: Marietti, 1948.

*Expositio Super Librum Boethii De Trinitate.* Leiden: E.J. Brill, 1955.

*In Duodecim Libros Metaphysicorum Aristotelis Expositio.* Romae: Marietti, 1985.

*In Libros Aristotelis De Caelo et Mundo Expositio.* Romae: Marietti, 1952.

*In Libros Aristotelis Meteorologicorum Expositio.* Romae: Marietti, 1952.

*In Libros Peri Hermeneias.* Romae: Marietti, 1955.

*In Librum Primum Aristotelis de Generatione et Corruptione Expositio.* Romae: Marietti, 1952.

*In Octos Libros Physicorum Aristotelis Expositio.* Romae: Marietti, 1954.

*In Posteriorum Analyticorum.* Romae: Marietti, 1955.

*Summa Contra Gentiles.* Paris: Marietti, 1967.

*Summa Theologiae.* London: Blackfriars, 1964-1981.

### **Translations and Selections:**

*Commentary on Aristotle's Physics.* Translation by Blackwell, Spath and Thirkel. London: Routledge & Kegan Paul, 1963.

*Commentary on the Metaphysics of Aristotle.* Trans. by John Rowan. Chicago: Henry Regnery Company, 1961.

*Commentary on the Posterior Analytics of Aristotle.* Trans. by Larcher. New York: Magi Books, 1970.

*The Divisions and the Method of the Sciences.* Trans. by Armand Muarer. Toronto: The Pontifical Institute of Medieval Studies, 1963.

*Exposition of Aristotle's Treatise On Generation and Corruption.* Trans. by Larcher and Conway. Columbus, Ohio: College of St. Mary of the Springs, 1964.

*Exposition of Aristotle's Treatise On Metereology.* Trans. by R.F. Larcher and P.H. Conway. Columbus, Ohio: College of St. Mary of the Springs, 1964.

*Introduction to St. Thomas Aquinas.* Edited by A. Pegis. New York: The Modern Library, 1948.

*On Being and Essence.* Trans. by Armand Maurer. Toronto: The Pontifical Institute of Medieval Studies, 1949.

*The Philosophy of Thomas Aquinas.* Edited by Christopher Martin. London: Routledge, 1988.

*The Pocket Aquinas.* Edited V.J. Bourke. New York: Washington Square Press, 1960.

*Summa Theologiae: A Consice Translation.* Edited by McDermott. London: Methuen, 1989.

*Treatise on Separate Substances.* Trans. by Francis J. Lescoe. Carthage: The Messenger Press, 1963.

### **Works By Aristotle:**

*De Caelo.* Trans. by Stocks. In *The Basic Works of Aristotle.* Edited by McKeon. New York: Random House, 1941.

*Ethica Nicomachea.* Trans. by Ross. In *The Basic Works of Aristotle.*

*Metaphysics.* Trans. by Ross. In *The Basic Works of Aristotle.*

*Physics.* Trans. by Hardie and Gaye. In *The Basic Works of Aristotle.*

*Posterior Analytics.* Trans. by Mure. In *The Basic Works of Aristotle.*

**Works on Topics in Aquinas and Aristotle:**

Bolton, R. *Aristotle's Method in Natural Science: Physics I.* In *Aristotle's Physics: A Collection of Essays.* Edited by Lindsay Judson. Oxford: Clarendon Press, 1991, pp. 1-29.

Chenu, M.D. *La Théologie comme science au XIII Siècle.* Paris: 1957.

Connolly, F.G. Science vs Philosophy. In *The Modern Schoolman*, vol. XXIX, 1952, pp. 197-209.

-----Abstraction and Moderate Realism. In *The New Scholasticism*, vol. XXVII, 1953, pp. 72-90.

Cunningham, F. A Theory on Abstraction in St. Thomas. In *The Modern Schoolman*, vol. XXXV, 1958, pp. 249-270.

De Koninck, C. Abstraction from Matter, Parts I, II and III. In *Laval Théologique et Philosophique*, vol.13, 1957, pp. 133-196, and vol. 16, 1960, pp. 53-69, and pp. 169-188.

De Rijk, L.M. *La Philosophie au Moyen Age.* Leiden: E.J. Brill, 1985.

East, S.P. De la méthode en biologie selon Aristote. In *Laval Théologique et Philosophique*, vol. 14, 1958, pp. 213-235.

Geiger, L.B. Abstraction et Séparation d'après S. Thomas. In *The Thomist*, vol. 22, 1959, pp.3-40.

Germain, P. L' étude des éléments dans le De Coelo et dans le De Generatione et Corruptione. In *Laval Théologique et Philosophique*, vol. 10, 1954, pp. 67-78.

Gilson, E. *God and Philosophy.* New Haven: Yale University Press, 1941.

-----*Le Thomisme: Introduction à la philosophie de Saint Thomas D'Aquin.* Sixième ed. revue. Paris: Librairie Philosophique, J. Vrin, 1986.

Griffin, J.J. The Interpretation of the Two Thomistic Definitions of Certitude. In *Laval Théologique et Philosophique*, vol. 10, 1954, pp. 935.

*Philosophy in the Middle Ages.* Edited by Hyman and Walsh. Indianapolis: Hackett Publishing Co., 1973.

Jaeger, W.W. *Aristotle.* Second ed. Translation by Robinson. Oxford: 1948.

- Kane, W. Abstraction and the Distinction of the Sciences. In *Thomist*, vol. 17, 1954, pp. 43-68.
- Leroy, M.V. Le Savoir Spéculatif. In *Revue Thomist*, vol. 21, 1948, pp. 236-327.
- Little, J. *Towards a Thomist Methodology*. Ontario: The Edwin Mellen Press, 1988.
- Makin, S. Aquinas, Natural Tendencies and Natural Kinds. In *The New Scholasticism*, vol. 61, 1989.
- Mansion, A. *Introduction à la Physique Aristotélicienne*. Louvain et Paris:, 1913.
- Mansion, S. *Le Jugement d'existence chez Aristote*. Louvain et Paris: 1947.
- McMahon, G. The Prooemium to the Physics of Aristotle. In *Laval Théologique et Philosophique*, vol. 13, 1957, pp. 9-57.
- Mead, H.L. The Methodology of Ptolemaic Astronomy: An Aristotelean View. In *Laval Théologique et Philosophique*, vol. 31, 1975, pp. 55-74.
- Merlan, P. Abstraction and Metaphysics in St Thomas' Summa. In *Journal of the History of Ideas*, vol. XIV, 1953, pp. 284-291.
- Moravcsik, J. What Makes Reality Intelligible? Reflections on Aristotle's Theory of Aitia. In *Aristotle's Physics: A Collection of Essays*.
- Mueller, I. Aristotle on Geometrical Objects. In *Articles on Aristotle*. Vol. 3, pp. 96-107.
- Natorp, P. Thema und Disposition der aristotelischen Metaphysik. In *Philosophische Monatshefte*, vol. 24, 1887.
- O'Flynn, S. The First Meaning of 'Rational Process' According to the Expositio in Boethium de Trinitate. In *Laval Theologique et Philosophique*, vol. 10, 1954, pp. 167-188.
- Patzig, Z. Theology and Ontology in Aristotle's Metaphysics. In *Articles on Aristotle*. Vol. 3, ed. Barnes, Schofield and Sorabi. London: Duckworth, 1979, pp. 33-49.
- Philippe, M.D. [Abstraction, Addition et Séparation] dans la philosophie d'Aristote. In *Revue Thomist*, vol. 21, 1948, pp. 461-479.
- Roberts, J.D. La métaphysique, science distincte de toute autre discipline philosophique, selon saint Thomas d'Aquin. In *Divus Thomas*, vol. 50, 1947, pp. 206-222.

Saint-Jacques, A. Saint Thomas D'Aquin et le premier fondement naturel de notre connaissance de Dieu. In *Laval Theologique et Philosophique*, vol. 30, 1974, pp. 349-378.

Samson, A. Aristote et les théories presocratique sur la connaissance. In *Laval Théologique et Philosophique*, vol. 22, 1966, pp. 22-44.

Simard, E. Aristote et les caracteres generaux d'une theorie scientifique. In *Laval Theologiques et Philosophique*, vol.10, 1954, pp. 146-166.

Simmons, E.D. In Defence of Total and Formal Abstraction. In *The New Schoolman*, vol. XXIX, 1955, pp. 427-440.

-----The Thomist Doctrine of the Three Degrees of Formal Abstraction. In *The Thomist*, vol. 22, 1959, pp. 37-67.

Smith, V. Abstraction and the Emperiological Method. In *Proceedings of the American Catholic Philosophical Association*, vol. XXVI, 1952, pp. 35-50.

Vander Weel, R.L. The Posterior Analytics and the Topics. In *Laval Théologique et Philosophique*, vol. 25, 1969, pp. 131-141.

Van Riet, G. La theorie de l'abstraction. In *Revue Philosophique de Louvain*, vol, L, 1952, pp. 353-393.

Wallace, W. Towards a Definition of the Philosophy of Science. In *Mélanges à la Mémoire de Charles de Koninck*. Quebec: Université de Laval, 1968.

Weispheipl. J.A. The Concept of Scientific Knowledge in Greek Philosophy. In *Mélanges à la Mémoire de Charles de Koninck*.

Wojciechoski, J.A. Réflexions sur le mode de savoir des sciences physiques. In *Laval Théologique et Philosophique*, vol. 20, 1964, pp. 9-34.

