INCOMMENSURABILITY IN ETHICS AND IN THE PHILOSOPHY OF SCIENCE

by

Andrew F. Reeve

A thesis
presented to the University of Waterloo
in fulfilment of the
thesis requirement for the degree of
Doctor of Philosophy
in
Philosophy

Waterloo, Ontario, Canada, 1999

0-612-51221-5

The University of Waterloo requires the signatures of all persons using or photocopying this thesis. Please sign below, and give address and date.

Abstract

'Incommensurability' has, in the last forty years, gained wide currency in the literature of philosophy. Kuhn and Feyerabend used the term in the early 1960's to describe an issue in the philosophy of science. They suggested that, when scientific theories are introduced that are significantly different from their predecessors, it may happen that the meanings of key terms differ significantly, and to the extent that scientists may be unable to fully comprehend the new theory until they experience a form of radical conversion, in which they come to fully grasp the new theory. Key contributions have been made to this literature by Bishop, Devitt, Margolis,, Sankey, and Scheffler.

The notion of 'incommensurability' has also been widely used in discussions of ethics. Finnis has used the concept to effect a taxonomy of human values, arguing that there are seven such values and that incommensurability is the feature that contradistinguishes them. Key contributions have been made to this literature by Goodman, Griffin, Pannier, Raz, and Williams.

In this work I discuss the literature of incommensurability in both the philosophy of science and ethics. I argue that there are at least two quite different notions of incommensurability: one is a well defined notion originally used by mathematicians; the other, less well defined, means, based on the etymology of the word, 'lacking a common measure'. I argue, further, that the discussions of Kuhn and Feyerabend are based on the mathematical notion, while the discussions in ethics are based on the etymological notion.

Further complicating the discussions in both ethics and the philosophy of science, is the connection between the notions of commensurability and comparability. I argue that the notions describe, differently, equivalent sets.

Ultimately Kuhn's notion fails because he cannot resolve his arguments for both inexpressibility in a common language and for comparability of competing theories. Finnis's notion fails because incommensurability does not, in fact, uniquely describe the taxonomy for which he argues.

Acknowledgements

Portions of my article "Incommensurability and basic values", published in *The Journal of Value Inquiry*, 1997, (31), 545-552, are reproduced herein with kind permission from Kluwer Academic Publishers.

Table of Contents

> We should not dare to class ourselves or compare ourselves with any of those who put forward their own claims. What fools they are to measure themselves by themselves, to find in themselves their own standard of comparison.[1]

1.0 Introduction

The word 'incommensurability' has very much come into vogue in recent years. Once used only to express a rather obscure, albeit interesting, point in mathematics, the word has gained wide currency since the nineteen sixties, when Thomas Kuhn used it to describe a phenomenon that, he argues, causes problems with our ability to choose among competing theories. (While Kuhn talks specifically about scientific theories, there are good reasons to suppose that his concerns may be applied to theory choice in general). In addition the term has gained currency in various discussions of ethics and in numerous other areas of philosophy. The popularity of the word is such that it seems omnipresent in the current literature and yet the term remains an elusive one, both in the sense that there is little detailed description of what the term is intended to represent, and in that, where there is detail, there is also significant disagreement. This work will investigate the main philosophical usages of this term and attempt to determine if these usages are usages that further the relevant philosophical discus-

---

[1]2 Corinthians, Chapter 10, Verse 12. *The New English Bible*.

sions or, rather, hinder them. While I will argue that these usages do, in fact, mask misleading implications, I will maintain that this is not really a prescriptive argument. My interest is not in arguing that any particular word is being used incorrectly, since I take it that a word will mean whatever we say it means, taking its meaning from the conventional usages we assign to it.[2] Rather, my view is that the usages, in these particular instances, are inappropriate because we tend to be too ready to attribute characteristics associated with one usage to the various other usages. The usages, in short, are not incorrect, either in whole or in part, but are, rather, unnecessarily confusing. They are, I believe, ultimately misleading for reasons that will be discussed. In any case, it would appear, these usages may easily be avoided by using terminology better suited to each particular discussion. And why, after all, should we take risks in a situation wherein an alternative path offers, at a minimum, the potential of improved clarity with reduced risk?

It is a fact either extremely coïncidental or extremely astute that the mathematicians, who appear to be the first ones to use the term 'incommensurability', chose to call 'irrational' those numbers that are incommensurable with the rationals. One may well imagine an early mathematician thinking that, while the integers and fractions, what we now call 'rational' numbers, somehow "made sense", these other numbers, the irrationals, somehow do not. The proof, as we shall see, seems to require us to accept the irrationals, but they appear to be fundamentally different from the numbers that had been previously known. This difference

[2]In this I agree with Humpty Dumpty: "When *I* use a word, it means just what I choose it to mean - neither more nor less" (*Through the Looking-Glass*, in *The Complete Works of Lewis Carroll*, (New York: Vintage Books, 1976), p. 214). Humpty's mistake is in supposing that he alone can determine the meanings of the words he uses.

was, of course, theoretically significant. The characteristics of mathematics, however, such as precision, made it a purely theoretical issue: since we can always determine, of any two incommensurable numbers, which one is the larger, incommensurability does not stop us from doing the calculations necessary to build bridges, or to execute computer simulations. It is not a hindrance to the practical applications of mathematics. There is a sense, then, yet to be properly explained in which we can, for these practical applications, commensurate the incommensurables, as puzzling as that may sound.

Prior to the discovery of incommensurability in mathematics it had been widely supposed that numbers represented perfect harmony and consistency. So much was this the case, in fact, that the discoverer of incommensurability was alleged to have died in order to prevent news of the discovery being spread abroad:

> It is well known that the man who first made public the theory of irrationals perished in a shipwreck in order that the inexpressible and unimaginable should ever remain veiled...and so the guilty man, who fortuitously touched on and revealed this aspect of living things, was taken to the place where he began and there is forever beaten by the waves.[3]

Now, clearly, incommensurability was not 'unimaginable', since it was, ultimately, imagined. Incommensurability, we might say, represents irrationality in the sense that the thing is 'unimagined', that it is far outside the bounds of our previous experience. But things may be unimagined and beyond the bounds of our experience for at least three different reasons. First, it may be, purely and simply, unimagined because we had no reason to imagine it. There was a time, for example, when airplanes were unimagined just because there was no reason to

---

[3]Scholium to Euclid, *Elementa, X, I*, quoted in Joseph Dauben's "Conceptual Revolutions", in Donald Gillies' *Revolutions in Mathematics*, p. 54.

imagine them.[4] Secondly, it may run counter to a set of beliefs we have, so that not only do we have no reason to imagine it but in fact we have reasons not to imagine it. We do not normally imagine a fallen apple rising to the tree since we hold a theory of gravitational force that prohibits such a thing. Thirdly, a thing may be unimagined where it is a definitional or logical impossibility. To say that a circle is not a square, for example, is to say that we use these words in such and such a way and that there is no meaningful way, at least in the usual senses of the words being used, for anything to be both of these things. So this kind of irrationality really represents several possible sorts of irrationality, which will need to be sorted out.

But there is another kind of irrationality at work here as well: the irrationality revealed by being unable to express irrational numbers in terms of the rationals. So there is the irrationality of having some numbers that are *not expressible* in terms of other numbers. Interestingly, while we cannot describe an irrational number in terms of rational numbers, the reverse is not always the case.[5] As Dauben notes in his discussion of the passage quoted above, the words 'inexpressible' and 'unimaginable' are both important. They seem to express two related, but distinct, notions of irrationality. Here again we will need to specify in more detail what 'inexpressible' might really mean as a kind of irrationality.

When Thomas Kuhn first published *The Structure of Scientific Revolutions* in 1962 he

---

[4]It should be made clear that I am not suggesting that any of these cases are cases where the things unimagined are unimaginable. Clearly somebody did come to imagine airplanes, else they would not have been invented. Similarly, we can easily imagine what it would be like for an apple to rise to the tree. The third sort of 'unimagined' however, seems rather different.

[5] $2 = \sqrt{2} \cdot \sqrt{2}$ offers an example of irrationals which provide an entirely effective expression of a rational.

was accused of proclaiming that science was inescapably irrational.[6] Proponents of different theories, he claimed, could not communicate effectively with each other, with the result that they 'talked through' each other. Their theories conditioned the way that they saw the world, so that they did not even see the same world as each other. Therefore, it was said, the choice between two theories was, ultimately, irrational. Indeed, if they cannot communicate, and if they lived in different worlds, it is difficult to see why the charge, at least of non-rationality, is not entirely legitimate. And ultimately, Kuhn claimed, this inability to understand each other fully is the result of incommensurability in the languages of the two theories, which makes it impossible to express key concepts of one theory in the language of the other.

A further charge against Kuhn was that his work made it impossible to allow for the notion of progress in science. If a theory could only be evaluated from within the framework of that theory, then there would seem to be no objective vantage point from which one might maintain that one of several competing theories was the best one. But how could theory choice be possible if it was not possible ever to determine that a theory could potentially be preferred to any other theory? Science, then, collapsed into relativism, and there was no escape. Incommensurability, whether the ultimate cause or the inevitable effect of relativism, is implicated in this chain of events.

In discussions of ethics the tone has been rather more subdued, but parallels clearly exist. If there are multiple human values which are incommensurable with each other, as John Finnis claims, how is it that we are able to choose a course of action among those open to us

---

[6]These claims will be examined in greater detail in Chapter 3.

but in which several competing values are exhibited?[7] If there is no way to measure, or perhaps even to compare, our preferences for incompatible scenarios, then how are we to make any choices at all in scenarios which exhibit these values? It would seem that we are, at that point, acting on a basis that is, if not irrational, at least non-rational. But if we, as moral beings, must choose a course of action, this seems to put us in an untenable situation, since we do generally hope not merely for choice, but for rational choice.[8]

Further, the notion seems to eliminate any possibility for the notion of progress in the moral realm in much the same way that it has been suggested that incommensurability renders nonsensical the notion of progress in science. John Gray writes:

> The idea of global progress in the arts is incoherent. It is incoherent, if only because the arts are not in the business of representation and of measuring, with ever greater accuracy, a wholly independent subject matter.[9]

Plausibly, incommensurability leads to a similar conclusion in comparing, say, two civilizations vis à vis their moral codes. If we accept that any civilization strives to exemplify only what that civilization values, then the notion of *global* progress is incoherent since progress can only be understood from within the context of the civilization itself. That is, if a privileged point of view is not available, then the notion of progress is not viable and there is no stance from which to make a judgment of preference for one system over another. Incommensurability in

---

[7]It should be noted that Finnis was not the first to introduce the term 'incommensurability' to discussions of ethics. In his *The Theory of Good and Evil*, published in 1907, Hastings Rashdall devoted an entire chapter to "The Commensurability of All Values".

[8]Alasdair MacIntyre has invoked the notion of incommensurability as a phenomenon that occurs between cultures, or traditions, that are so different that difficulties of translation between them, or of understanding each other, are evident.

[9]John Gray, *Post-liberalism* (Routledge: New York, 1993), p. 290.

the moral realm leads, therefore, to a relativist view. Since there is no independent perspective that enables us to measure the values exhibited in a moral act as compared to some competing act (i.e. an alternative and incompatible act), we can only understand and evaluate that act from within the moral framework in which we are acting. (Gray, in fact, goes on to argue that incommensurability and value pluralism do not necessarily lead to a relativist view, but it is difficult to reconcile this with the belief that the notion of progress is incoherent wherever the business of representing and measuring is not actively pursued.[10])

Incommensurability is inextricably bound up with these questions, in both the philosophy of science and in ethics. Perhaps, then, if there is incommensurability, there can be no measure of progress. If there is incommensurability, therefore, there can be only relativism. But what is incommensurability? Why should it be thought to have such a pervasive influence in these two fields? And if its influence is so pervasive in these two fields then why should it not have similar influence in virtually all fields? Or is the notion mistaken? Is what has come to be called 'incommensurability' rather something else, perhaps even something quite ordinary? The questions are important because the consequences are so significant.

To serve as the basis for this discussion I turn first to a brief look at measurement and then to an examination of 'incommensurability' in its various usages, including both the

---

[10]Interestingly, Gray appears to betray himself on the page immediately preceding the passage quoted above, where he claims that we can easily judge the poetry of Hopkins to be superior to that of e.e. cummings. But how is this possible if the notion of progress is incoherent? While Gray does say only that *global* progress is incoherent, he claims that this incoherence is the result of his alleged fact that the arts are not in the business of representing and measuring. But, then, why should this not also demonstrate that the idea of local progress is likewise impossible? It may also be allowed that Gray is probably not thinking of e.e cummings, since he refers to his poetry as 'doggerel'. cummings' poetry may be referred to as many things, but 'doggerel' suggests that Gray is probably thinking about someone like Ogden Nash.

etymology of the word and the mathematical usage of the word in the context of geometry. An understanding of how the word has been used in the past will provide, hopefully, the basis for an examination of the philosophical usages.

1.1 On measurement

When we measure we apply some scale, or unit of measure, to the thing to be measured and attempt to determine how many units of that scale the thing in question exhibits. Obvious examples include measuring a pumpkin to determine its mass in kilograms, or measuring the distance, in kilometres, from one city to another. We need, in short, a subject (i.e., a thing to be measured), a scale, and a determination of value.

When we measure we do so for quite a wide variety of reasons. Scientists may measure the distance to a particular star. They do so, first of all, because they have a thirst for knowledge and part of what they wish to know about a star is its distance from the earth. A chef making a particular dish measures out the ingredients, but not from a thirst, or hunger, for knowledge. He does so because that is part of the way to make a dish with consistency, which, presumably, is what he wishes to do. A surveyor measures because that is what a surveyor does. Others make use of the survey for various reasons, but a surveyor, in measuring, is doing what he is employed to do. A car magazine testing a new model measures various aspects of the car's performance. They do so in order that their readers may make comparisons among various cars, perhaps even to assist them in making buying decisions. So there are various reasons why we may wish to measure things, one of which is that it enables us to make comparisons.

At least three different kinds of scales have been distinguished.[11] In an absolute scale, both the unit and origin are pre-determined by the nature of the subject. Counting is usually an example of this. If we count apples, the obvious unit of measure is 'one apple'. The origin is the empty set, i.e. 'zero apples'. The count of any given set, therefore, may be determined uniquely, given that the unit of measure and the origin are fixed.[12] In the second kind of scale, the ratio scale, the origin is determined but the choice of unit of measure is not. Examples here include weights and distances. Apples may be weighed in pounds or kilograms, since the choice of unit of measure is in no way pre-determined, but the origin is still the empty set, 'zero pounds (or kilograms) of apples'. Distances may be measured in miles or kilometres, but the origin is determined (as is the end point, in this case). Once the unit of measure is determined however, ratios between two measurements will be maintained. To borrow Suppes' example, the ratio of the distance between two pairs of cities remains constant whether that distance is measured in miles or kilometres or inches or light years or any other measure of distance. In the third kind of scale, the interval scale, neither the unit of measure nor the origin are pre-determined. Most temperature scales and time scales are of this sort. In the Fahrenheit scale, for example, 0° represents nothing special, while in the Celsius scale 0°

[11] See the entry for "Measurement, Theory of" by Patrick Suppes, in the *Routledge Encyclopedia of Philosophy*, Version 1.0 on CD/ROM (London: Routledge). It is not clear whether these three kinds of measurement are put forward as a well-defined and exhaustive list or, rather, as a quick intuitive list.

[12] It is less than clear that the notion of an absolute scale is viable. It may be argued, for example, that we may as easily count apples in quarters or by 10 lb. bags, and that the fact that apples may be counted as individual units does not make this unit of measure, in any sense, absolute, or determined, or even natural. We do not generally measure sand or rice by the grain, for example, even though these may be said to be natural units.

represents the freezing point of water. Since both unit of measure and origin are arbitrary, ratios will not normally be maintained between measurements.[13]

Suppes further distinguishes five kinds of mistakes that may occur in measurement. First, there may be faults in the instruments used in measurement, such as clocks, telescopes, spectrometers, etc. Secondly, the observer may be at fault in his observations. Thirdly, systematic errors may occur which affect the measurement, such as headwinds that must be properly accounted for in order to determine the ground speed of an airplane. Fourthly, random errors may affect the measurement, such as unusual weather conditions that affect astronomical observations. Fifthly, errors may occur in calculations after the data have been recorded.[14]

In the attempt to apply a unit of measure there are various implications which it may be worth our while to make explicit. First, we must be able to produce an acceptable standard for this unit of measure. If we wish to measure a distance in metres, for example, we must be able to, if pressed, produce the standard itself (perhaps a platinum bar in Paris) or, failing that, to produce some credible replica (perhaps a metre stick). Secondly, we need to know in what kinds of cases the unit in question is appropriate for the job, i.e., we need to know to what

---

[13]The Kelvin scale of temperature does, of course, have a pre-determined origin, viz., absolute zero. Since other scales of temperature, however, do not have a pre-determined origin, ratios will not be maintained between scales. It would, of course, be possible to invent a temperature scale that does maintain ratios with another temperature scale (as, for example, will happen between Kelvin and Celsius) but the point is that the ordinary temperature scales already in use do not do so.

[14]This list, again, may not be put forward by Suppes as an absolute or complete list of the kinds of errors that can occur, but is likely intended simply as a representative list of the sorts of errors that do occur.

kinds of things we will apply the measure, and in what cases the application is appropriate. Metres, for example, are appropriate for measuring the heights of buildings but are not normally used to measure the intensity of colours. Metres are also not appropriate, in any obvious way, for measuring 'the heights of buildings as a reflection of advances in engineering technologies throughout the twentieth century'. Thirdly, we need to understand the methodology as to how to determine specific numerical values of our unit of measure in particular cases (i.e., how to determine how many units of our unit of measure our subject exhibits). To say that someone is 'somewhat tall' is not to take a measurement at all, since there is no assignation of numerical value of a specified unit of measure; this is merely to make a casual observation. Measurement must have some assignation of value. Note, however, that, since the choice of unit of measure is conventional, we may readily agree to a unit of measure in a specific context that we would not ordinarily use. For example, one can imagine a case where one is shown two structures in the distance, one twice as tall as the other. Suppose we are told by a credible person that the structures are equidistant, but we discover that there are no visual cues that would enable us to judge their actual heights according to any standard scale, even approximately. Clearly we can compare their heights relative to each other. But is there a way in which we can be said to have measured the structure? Even in this case, it seems that we do have a unit of measure that we can apply, viz. the height of the smaller tower, which can take the value of 'one unit'. We can then determine that the larger tower takes the value of 'two units', so it does appear that we have measured the structures since we have determined an acceptable scale and have been able to effect an assignation of values to the things being measured. The nature of the relationship between comparability and commensurability will eventually become crucial to our understanding of the subject and will recur frequently in our discussions.

1.2 The various uses of 'incommensurability'

The etymology of 'incommensurable' seems to be quite straightforward. '*Cum mensurare*' is a Latin phrase meaning *to measure with*, *to measure jointly*, or *to measure together*. So two things are said to be commensurable if there is, or can be shown to be, a common measure that can be used to measure both of the things under discussion. The two things are incommensurable if there exists no such common measure.[15] By 'measure' I mean here simply a standard of measurement that provides a unit to measure the things under discussion, generally referred to as a unit of measure. For example if we are to measure the height of two people, then appropriate measures would include inches or centimetres (although not generally at the same time).

As will be discussed in more detail in Chapter 4, it should be noted here that to speak of two things as being commensurable, or incommensurable, is not really accurate. The heights of any two people are commensurable, but other aspects of the same two people may not be so. In fact, we shall ultimately determine that things themselves are, properly speaking, neither commensurable nor incommensurable. Things are commensurable, or incommensurable, only with respect to a specified property. In speaking of things, therefore, we should always specify to what property we are attempting to ascribe commensurability or

[15]A further complication, which is examined later in this chapter (Section 1.6), is whether we mean that *in fact* there is no measure or whether we mean that there *can be* no measure.

incommensurability and, in ascribing commensurability, we should further specify the unit of measure we are using. In fact we are generally able to understand from the context of the situation what property is under consideration, and it is often similarly understood what unit of measure we are using, but properly speaking 'incommensurability' is always incommensurability of a specified property of object A with a specified property of object B', which may, for now, be the same property of two different objects, or different properties of two different objects, or different properties of a single object. Note that we do not specify the unit of measure in the ascription of incommensurability since the point of incommensurability is that there is no such measure available.

Some examples of cases in which we may wish to ascribe commensurability, or incommensurability, may help in the understanding of these various cases. To say that you and I are commensurable with respect to height is a case of noting the commensurability of the same property of two objects (i.e., of two objects with respect to a single property). To say that my height is incommensurable with your weight is a case claiming incommensurability of different properties of two objects (or, more properly, claiming incommensurability of two objects with respect to two properties). To say that my height is incommensurable with my weight is a case ascribing incommensurability to different properties of a single object (or, more properly, claiming incommensurability of a single object with respect to two properties). We will never come to discuss the fourth possible case, which is that of the same property of a single subject, since it seems clear that anything that can be measured is commensurable with itself. Note that, even in this case, we are not necessarily saying that everything is commensurable with itself, since we may determine that a property is not measurable at all, in which case it will not be commensurable with itself. The discussion as to whether there are such properties will be left until later.

Two common, but distinct, usages of 'incommensurability' that are distinct from the etymological usage should also be noted here. The word is often used to mean 'disproportionate'. One may say, for example, that severing a hand as punishment for petty thievery is incommensurate with the crime, meaning simply that the punishment is far too severe for the offence. In this case the relation to measurement is rather remote, suggesting not that there is no common scale available but, rather, that we are assigning values at the wrong end of the scale that we are using. The second common usage of 'incommensurability' is that where the word is used to mean, simply, 'not comparable'. This usage, at first glance, appears to have no direct relation to the notion of measurement, but, as we shall see, much remains to be said about the relationship between commensurability and comparability.

'Incommensurable' in its mathematical usage is, one might suppose, very much in line with the etymology of the word, pertaining to the lack of a common measure. One mathematical dictionary even offers this as a definition of incommensurability: "Not having a common measure, i.e., not having a common unit of which both are integral multiples".[16] Not all numbers, that is, resolve into integral ratio. This 'common unit' is lacking for incommensurable numbers. So two numbers are commensurable if they may both be expressed in terms of some other specified number multiplied by an integer. If there is no common integral multiple then the numbers are incommensurable. For example, the square root of the number two is

[16]Robert C. James. *Mathematics Dictionary*, 5th ed. (New York: Van Nostrand Reinhold, 1992), p. 213. *OED* offers a similar definition for the mathematical notion of incommensurability: "Not commensurable; having no common measure (integral or fractional)."

incommensurable with the integer three, since the integer three can be expressed as the ratio of two integers (e.g., 3/1) while the square root of the number two cannot be expressed in this way. This fact of incommensurability serves as the distinction between the rational numbers and the irrational numbers, which together make up the set of real numbers. Rational numbers include the integers and those numbers which are commensurable with the integers. Irrational numbers include just those real numbers which are not commensurable with the rational numbers.

As we shall soon see, however, it is misleading, even false, to suppose that 'lacking a common measure' is an adequate gloss for this mathematical usage. There is a crucial added condition in this specialized usage, viz., that the numbers cannot be resolved into integral ratio.

1.3 The mathematical proof of incommensurability

It is quite simple to prove that there are incommensurable numbers. The proof is as old as the Pythagorean school of ancient Greece. The commonest proof is a reductio in which it is assumed that the length of the side of a square is commensurable with the length of the diagonal. It is then demonstrated that this assumption requires that one of those numbers be both odd and even, which is impossible.[17] Since the assumption of commensurability results in a contradiction, we know that our assumption is incorrect and that, therefore, the numbers are not commensurable. While the proof is very short I will lengthen it somewhat beyond the standard presentation to make each step explicit, which steps may not be obvious to those not

[17]In standard set theories, infinite numbers are sometimes said to be both even and odd, but this need not concern us here since it is clear that neither of the numbers in question is infinite.

versed in mathematical proofs.[18]

Consider a square ABCD with sides equal to one unit. Suppose that the diagonal, AC, is commensurable with a side, AB. Let $\alpha : \beta$ be the ratio of AC to AB expressed in the smallest possible numbers. We have stipulated that the sides of the square measure one unit, so $AB=\beta=1$. Now $\alpha > \beta$, since the diagonal of a square is longer than any side. Since $\beta = 1$, then $\alpha > 1$.

Now	$AC : AB = \alpha : \beta$	as stipulated above
so	$AC^2 : AB^2 = \alpha^2 : \beta^2$	
	$AC^2 = 2AB^2$	by the Pythagorean theorem
so	$\alpha^2 = 2\beta^2$	

Therefore α^2 is even (since it equals $2\beta^2$ it must be even since it is divisible by 2). So α is also even (since the integral square root of any even number is also even). Therefore β must be odd (since, if it was even, $\alpha : \beta$ would not have been expressed in the smallest possible numbers, which is contrary to our assumption; α is even, so, if β was also even, they would both be divisible by 2).

Since α is even, let $\alpha = 2\gamma$. Since $\alpha^2 = 2\beta^2$, then $(2\gamma)^2 = 2\beta^2$, or $4\gamma^2 = 2\beta^2$, which is to say $2\gamma^2 = \beta^2$. Therefore β^2 is even (since it equals $2\gamma^2$ it must be divisible by 2, so it is even). So β is also even (since the integral square root of any even number is also even).

So our assumption of commensurability implies that β is both odd and even, which is impossible. Therefore our assumption must be incorrect and α and β are incommensurable.

---

[18]This proof may be found in many texts on mathematics. See for example Sir Thomas Heath's *A History of Greek Mathematics, Volume 1*, Oxford, Clarendon Press, 1921, p. 91.

1.4.0 The characteristics of mathematical incommensurability

To define incommensurability in mathematics, and to demonstrate that it does occur, does not really tell us the whole story. Mathematics represents a well-defined context in which we have been able to demonstrate that incommensurability, in the particular sense attached to that word in mathematics, does occur. But there are characteristics of this context without which incommensurability could not arise; these are, as it were, the preconditions of incommensurability in mathematics. In addition, there are characteristics of incommensurability that are not immediately apparent and which, when made explicit, will add to our understanding of the concept. These characteristics we must now make explicit if we are to fully understand the mathematical notion of incommensurability.

1.4.1 That incommensurable numbers are comparable

First, we note that two numbers which are incommensurable are nevertheless comparable.[19] By 'comparable' I mean here 'comparable with respect to the standard ordering of the real numbers'. Given any two numbers, x and y, if they are incommensurable then we know that $x \neq y$, since any number is in integral ratio with itself. In saying that x and y are yet comparable we mean that there is a correct answer to the question as to whether $x > y$ or,

---

[19]In saying of two things that they are not comparable I will use 'non-comparable' throughout the work rather than 'incomparable', which often has a connotation of 'better than the rest'. When I say that two things are non-comparable I mean simply that they cannot be compared, although we will not commit at this point as to whether non-comparability arises because the characteristics are non-comparable simpliciter, or whether non-comparability arises because there are no shared characteristics at all, or whether both situations may arise. The possibility of such things will be much discussed in later chapters.

rather, y>x. We know that the square root of any positive integer is less than or equal to the integer itself. Therefore, we know that the square root of two is less than or equal to the integer two. We know that the integer two is less than the integer three. Therefore, by transitivity of the relation, we know that the square root of two is less than the integer three. The numbers are incommensurable but not non-comparable. Further, this characteristic of comparability arises no matter how close in value the numbers may be to each other, which leads us to the next characteristic.

1.4.2 That no restriction of precision is possible

The square root of two, to five significant digits, is 1.41421. But expressed this way we have lost something. In a sense we have lost incommensurability, since, clearly, 1.41421 is commensurable with the integer three since it can be expressed as the ratio of two integers. But the same loss of incommensurability occurs if we restrict the expression of the square root of two to any number of significant digits whatsoever. Any restriction of precision precludes the occurrence of incommensurability. This must be the case since an irrational number, expressed in decimal form, is an infinite non-repeating decimal. But the irrationals are just the numbers that are incommensurable with the rationals. But if we restrict the precision to less than infinity, they can no longer be expressed as infinite non-repeating decimals, and so they are not irrationals. Without infinite precision, incommensurability cannot arise. It is for this reason that we do not find engineers abandoning building designs on the basis that pieces cannot be cut to fit. The limit represented by incommensurability is very much a theoretical limit rather than a pragmatic limit, and any pragmatic curtailing of significant digits will eliminate incommensurability.

1.4.3 That the determination is objective

Incommensurability in mathematics is well-defined and well-understood. Mathematicians can be expected to reach general agreement on whether or not any two real numbers are incommensurable or not. This is not to say that there are no areas of significant disagreement among mathematicians, but those who subscribe to the classical account of the reals do not disagree about either incommensurability or what produces it. It is an objective matter whether two reals are incommensurable, so each mathematician who considers the question carefully will attain the same result. There is no subjectivity involved in answering such a question. Incommensurability itself is well-defined, and the techniques used to establish incommensurability are well-defined. In this sense the determination of incommensurability is objective.

1.4.4 That there are no degrees of incommensurability

Two real numbers are either incommensurable or they are not. Two incommensurable numbers are neither more nor less commensurable or incommensurable than any other two incommensurable numbers. Incommensurability is a binary switch, like a binary relation on numbers being commutative or not. The characteristic of commutativity either applies or it does not. Similarly, two numbers are either incommensurable or they are not, the test being whether or not there is "a common unit of which both are integral multiples".[20]

---

[20]Robert C. James, op. cit.

1.4.5 That incommensurability is non-transitive

Two numbers that are incommensurable with the integers may be commensurable with each other or they may not. $\sqrt{2}$, $\sqrt{3}$, and $\sqrt{8}$ are all incommensurable with the integers. Now $\sqrt{3}$ is also incommensurable with $\sqrt{8}$ since there is no reason to suppose that there are integers x and y such that $\sqrt{3}x = \sqrt{8}y$. However, we know that $2 \times 4 = 8$

therefore, $\sqrt{2 \times 4} = \sqrt{8}$

therefore, $\sqrt{2} \times \sqrt{4} = \sqrt{8}$

therefore, $\sqrt{2} \times 2 = \sqrt{8}$

Since $\sqrt{8}$ can be expressed as the product of $\sqrt{2}$ an integral number of times we know that the two are commensurable with each other. So the relation of incommensurability in mathematics is non-transitive: if α is incommensurable with β, and β is incommensurable with γ, we do not know, purely on the basis of these facts about the relation, whether α and γ are incommensurable with each other or not.

1.5 Incommensurability as 'lacking a common measure'

I have so far spoken of incommensurability as meaning, briefly, 'lacking a common measure'. I shall continue to speak this way even though it is somewhat at odds with the mathematical usage. The set of real numbers comprises both the rationals and the irrationals. Incommensurable numbers, therefore, may not be thought to be lacking a common measure because the standard ordering of the reals is, itself, a common measure in the sense that we are perfectly able to assign values to every number, both rational and irrational, and perfectly able to express the difference between any two real numbers. In this sense, then, 'lacking a common measure' is not an accurate description of mathematical incommensurability.

An interesting point that will be discussed in the chapters to come is that incommensurability is only interesting in cases in which we expected to find commensurability. We can imagine many things which we do not suppose that we, or anyone else, will ever attempt to measure on a single scale, and it does not seem especially remarkable that these things should be incommensurable. Now we have said that commensurability means, briefly, that we can describe a unit of measure together with the rules on how to apply it. There are many cases, then, where we believe that there is no common unit of measure, so these will be cases in which we believe that the characteristics in question are incommensurable, but not interestingly so. We must decide at some point in what cases it is reasonable to expect commensurability, since these will provide the only interesting cases of incommensurability. Early mathematicians supposed that all numbers could be resolved into integers, which is the 'measure' they expected to apply to all numbers. Since there was an expectation of commensurability, incommensurability in mathematics is interesting. Still, however, from the modern perspective, 'lacking a common measure' is confusing since the reals, in a sense, enable the common measure.

Now this does not seem to be a serious problem since neither the mathematician, nor I, suppose that this ordering on the reals in some way resolves the kind of incommensurability that mathematicians talk about. In fact, as we have said, the existence of the reals enables incommensurability, since mathematical incommensurability is a relation on the reals. While we may say that 1 and $\sqrt{2}$ are incommensurable, we can also measure each of the numbers as a real number. We can measure the distance between the two numbers based on the usual ordering of the reals: $\sqrt{2}-1$ is an irrational number, just as $\sqrt{2}$ is an irrational number. But then we are not lacking a common measure at all. The sense in which numbers are incommensurable is a specialized sense that adds a crucial extra condition to the etymological notion of incommensurability, viz., that the numbers are not in rational proportion. We shall see in the chapters ahead that both the etymological usage of incommensurability, meaning 'lacking a common measure', and the mathematical usage, meaning 'lacking a common integral multiple', have been used as the basis of the philosophical discussions we shall examine, and it will be important to recognize which usage is serving as this basis.

While we will use the mathematical sense of 'incommensurability' as a starting point for discussion, we must also recognise the limitations of doing so. It is useful to us, since it is the one usage of the word that is well-defined and well understood. Its application is objectively determined. Therefore, we may use the mathematical usage to investigate other usages to determine if there are similarities among the various usages. We may compare the characteristics of mathematical incommensurability to other usages to see if these characteristics have counterparts in the other usages. That being said, the mathematical usage is not, in any sense, a privileged usage. There is no reason, for example, to suppose that characteristics associated with the mathematical usage must also be associated with other usages. As per the previous paragraph, we cannot claim even that the mathematical usage is a literal usage, since it is not wholly based on the etymological usage: we have seen, in fact, that 'lacking a common measure' is a rather confused way of abbreviating the mathematical usage. All we can say, at this point, about the etymological usage of 'incommensurability' is that it ought to mean something like 'lacking a common measure'. We shall soon discover that it is not at all easy to understand this as it stands. We can already see that the mathematical case does not offer a straightforward etymological usage of the word since we have seen that there is a perfectly acceptable sense in which we can maintain that there is no lack of a common measure in the mathematical usage.

A further complication to this understanding of 'incommensurability' lies in our understanding of its connection with comparability. We shall find in the discussions ahead that many writers are confused about the relationship between the two concepts and clarification is badly needed, which will be attempted in Chapter 4. Even in our discussion of comparability in mathematics we have so far over-simplified the discussion by stating boldly that numbers which are incommensurable are yet comparable. But we see now that incommensurability in mathematics adds an extra condition to the etymological usage, so that it is no longer clear that incommensurability in the etymological usage must also support comparability. Indeed, we shall see that there is a perfectly good sense in which numbers that are incommensurable in the mathematical sense are commensurable in the etymological sense, which calls into question the significance of the relationship between the mathematical usage of 'incommensurability' and comparability. We shall ultimately argue that comparability entails commensurability (in the etymological usage) and vice versa, so that the two assertions describe, differently, equivalent sets. Since numbers that are incommensurable in the mathematical usage are yet commensurable in the etymological usage, it is no surprise to find that they are yet comparable. We must be very careful if we attempt to use the mathematical usage to better understand the other usages we will investigate.

1.6 'Incommensurable' versus 'incommensurate'

Normally in English an adjective of the form 'x-able' means 'able to be x-ed', so that 'paintable' means 'able to be painted', and 'incommensurable' means 'not able to be commensurated'. For the etymological case, then, 'incommensurate' means 'lacking a common measure' while 'incommensurable' means 'not able to be commensurated', or, perhaps, 'not capable of having a common measure'. This latter adjective, then, makes a much stronger assertion than the former, since its assertion brings with it the burden of proof that the common measure cannot be found. Proving that something cannot be found is, of course, notoriously difficult. The mathematical usage of 'incommensurable', on the other hand, means that the numbers in question are 'not able to be commensurated', or 'not capable of having a common integral multiple'. In mathematics, however, such a proof is generally available to us, so that the terms may be used interchangeably. In neither usage, then, will we allow this passage:

> In this example, deliberation has rendered initially incommmensurable end commensurable. [21]

Incommensurable ends cannot be rendered commensurable since, if they were rendered commensurable, then they could not have been incommensurable in the first place. However, it may be possible, if 'incommensurability' is understood in a sense other than the mathematical

---

[21]Elijah Millgram, "Incommensurability and Practical Reasoning", in Ruth Chang's *Incommensurability, Incomparability, and Practical Reason*, p. 160.

sense, to render incommensurate ends commensurate. Throughout the balance of this work I shall endeavour to be conscientious in using the correct adjectival form where the etymological usage is under consideration.

This does not, by itself, resolve the question as to whether 'incommensurability', in the etymological usage, is possible. In other words, is it sometimes possible to make the stronger claim that there *can be* no objective common measure between two given subjects? It does seem that this may particularly occur in cases in which no objective measure can expect to be found because the nature of the property to be measured is subjective. 'Pleasure', for example, can only be 'pleasure to an individual'. But no truly objective measure can be found for such a property because it is subjective. Now this is not to say that an individual may not possibly derive, for their own purposes, a calculus of pleasures that enables them to rank their own preferences at a point in time, but we can maintain that they could not communicate such a measure to another person so as to effectively, and convincingly, provide inter-subjective commensurability (or commensurateness). This is not to say that we do not normally come to expect others to exhibit behaviours that suggest that their response to pleasures, pains, etc., is quite similar to our own. There are, however, quite enough counter-examples to prevent us from hoping for anything like the agreement necessary to support an assertion of inter-subjective commensurability.

1.7 Incommensurability as a philosophical concept

In recent decades a number of philosophers have begun to use the word 'incommensur-ability' to express several distinct notions that are also distinct from the mathematical notion and, in some cases, altogether distinct from the notion of measuring as well. At least four quite different usages are apparent in the literature. Thomas Kuhn and Paul Feyerabend have used the word to describe problems related to theory choice in the philosophy of science. John Finnis and others have used the word to attempt a taxonomy of human values in their writings on ethical theory. Jaako Hintikka and others have described a very different issue in theory choice in the philosophy of science, which relates to the consequences of theories. Bjorn Ramberg and others have used the word to describe a set of issues surrounding our ability to communicate.[22]

Now of these documented uses of the term, Finnis's usage is quite close to the etymological usage, seems to fulfill a useful function, and has a significant following in the literature. The notion of Kuhn and Feyerabend, which is a derivative of the mathematical usage, has been widely discussed and deserves closer examination. The notions of Hintikka et alia are widely divergent from both the etymological and mathematical usages and have not been much discussed in the literature. The notions of Ramberg et alia are, again, completely removed from the two described usages and, although the phenomenon described is important and worthy of detailed research, it does not appear to provide an instance of incommensurability in any of the senses we have so far briefly mentioned.

By way of roadmap for what follows, in Chapter 2 I discuss Finnis's usage; in Chapter 3 I discuss the writings of Kuhn and Feyerabend and the various threads which have resulted;

---

[22]I do not include as a separate usage that developed in the Sapir-Whorf hypothesis. The usage is implicit in Kuhn's usage, and was extremely influential in Kuhn's thinking. Kuhn explicitly admits as much in his reference to Whorf in the Preface to *The Structure of Scientific Revolutions*.

Chapter 4 covers the related notions of comparability and commensurability and the likelihood of finding viable usages of 'incommensurability'; Chapter 5 is a summary chapter. A brief discussion of the notions of incommensurability put forth by Hintikka, Ramberg, and others, may be found in the appendix, as they are mentioned in various of the chapters.

2.0 Finnis and incommensurability - the theory

Over the years philosophers, anthropologists, sociologists, psychologists, and other observers of human nature have offered lists, ordered or otherwise, of basic goods, drives, tendencies, values, or features. Abraham Maslow's hierarchy of human needs is perhaps the most celebrated of these lists, including the following five levels:

(1) physiological needs

(2) safety needs

(3) belongingness and love needs

(4) esteem needs

(5) needs for self-actualization[1]

Since the list is hierarchical, the sequence of satisfaction of the different levels of needs is apparent and well-defined (although no claim is made that this translates into a hierarchy of human values). The notion is that a hungry man, suffering a level (1) need, does not pursue aesthetic enjoyment, a level (5) need, since the more basic needs (i.e. those higher on the list) demand satisfaction prior to satisfaction of the less basic needs. The argument is not that a

---

[1]Maslow, *Motivation and Personality*, 2nd ed. (New York: Harper & Row, 1970), pp. 34-37.

hamburger is better than a Brandenburg, but that if we are hungry we will try to satisfy that need before pursuing matters of self-actualization.

Philosophers, with a more specialized focus on what have come to be referred to as 'human values', have also offered lists. G.E. Moore, for example, argues in *Principia Ethica* that there are two areas of intrinsic value: "personal affections and aesthetic enjoyments include all the greatest, and by far the greatest, goods we can imagine".[2] In contrast to Moore's view, John Finnis, writing in *Natural Law and Natural Rights*, presents a list of seven basic values: life, knowledge, play, aesthetic experience, sociability, practical reasonableness, and religion.[3]

Finnis's list is different from Maslow's in at least one important respect, which is that Finnis's list is explicitly not hierarchical:

> ...each of the basic aspects of human well-being is equally basic...,none is objectively more important than any of the others, and...none can provide a common denominator or single yardstick for assessing the utility of all projects; they are incommensurable, and any calculus of consequences that pretends to commensurate them is irrational.[4]

Finnis is here making two points of significance about his list of values. First, that it does not present a hierarchy of values but, rather, a collection of equally important values. Secondly, that any one of the values is incommensurate[5] with any other value on the list. Unfortunately,

---

[2]Moore, *Principia Ethica* (New York: Prometheus Books, 1988), p. 189.

[3]Finnis, *Natural Law and Natural Rights* (Oxford: Clarendon Press, 1980), pp. 86-90.

[4]Ibid., p. 112.

[5]I use 'incommensurate' rather than 'incommensurable' here since I will be arguing that Finnis is using the term based on the etymological usage. Most of the passages quoted in the chapter, of course, will not follow this practise.

it is not yet apparent what 'incommensurate' really signifies here, and it is far from clear that anyone can sensibly maintain of any two things that they are both equally basic and incommensurate. In the mathematical usage, for example, we have seen that two numbers that are incommensurable cannot be equal since, if they were, the numbers could not have been incommensurable in the first place and would not, of course, be two numbers after all, but only one. But if equality precludes incommensurateness in the non-mathematical case also (as seems likely), then Finnis's values, if equally basic, are not incommensurate. An obvious avenue open to Finnis here, however, is to distinguish between, say, 'centrality to the human condition' and 'having equal value'. When Finnis says 'equally basic' he presumably means the former rather than the latter. In other words, this is a case where we must differentiate between 'incommensurateness with respect to centrality to the human condition' and 'incommensurateness with respect to value', since it seems likely that Finnis is speaking here of two distinct characteristics. This again reinforces the importance of recognizing precisely which property it is to which we are ascribing incommensurateness.

It would appear from Finnis's talk of common denominators and single yardsticks that by 'incommensurateness' he is referring to the 'lack of a common measure' usage rather than either a simple lack of comparability as discussed in a different usage previously noted in Section 1.2, or the mathematical usage with its additional condition. Finnis himself, however, is rather vague about precisely what he means by the term. He says, for example:

> One can compare the strength and degree of one's desire to have a cup of tea now with one's desire to have a cup of coffee now, and the degree of the respective enjoyment or satisfactions. But how can either of those desires and their satisfaction be compared with one's desire to be a fine scholar, a craftsmanlike lawyer, a good father, a true

> friend...?[6]

Here he seems to suggest that there is no comparability among instances of differing values, which seems to suggest that by 'incommensurateness' he does mean 'non-comparable' rather than 'lacking a common measure'. Elsewhere, however, we find the following:

> The basic values, and the practical principles expressing them, are the only guides we have. Each is objectively basic, primary, incommensurable with the others in point of objective importance. If one is to act intelligently at all one must choose to realize and participate in some basic value or values rather than others, and this inevitable concentration of effort will indirectly impoverish, inhibit, or interfere with the realization of those other values.[7]

But here it is clear that Finnis does expect us to act intelligently and that, in doing so, we must choose among the competing alternatives, which alternatives exhibit the various values in which we are able to participate. But, if we are to act intelligently in choosing, then these choices must somehow allow for us to make rational choices among various competing alternatives, which must allow for us to compare these alternatives, else we would not be able to make rational choices. I shall suppose, then, that Finnis means by 'incommensurateness' not 'non-comparability' but, rather, 'lack of a common measure', taking, again, his talk of 'common denominators' and 'single yardsticks' as evidence. Once again, however, we must recognise that there is something rather strange in this relationship between commensurateness and comparability, and Finnis seems not to take a firm position on the distinction between the two. I shall ultimately argue, as mentioned previously, that the two concepts may be used to independently describe equivalent sets.

---

[6]Ibid., pp. 114-115.

[7]Ibid., pp. 119-120.

Finnis does acknowledge that others have also produced lists of values, and he declines to take issue with these other lists: "There is no magic in the number seven, and others who have reflected on these matters have produced slightly different lists, usually slightly longer."[8] For Finnis, it seems, incommensurateness is, perhaps among other things, the differentiator among human values.[9] We will have more to say on this point later.

2.1 Other views on incommensurateness in ethics

Joseph Raz, also writing on the incommensurateness of human values, makes very clear what he means by 'incommensurateness': "I will use 'incomparable' and 'incommensurable' interchangeably."[10] More explicitly: "A and B are incommensurate if it is neither true that one is better than the other nor true that they are of equal value."[11] Raz does maintain that we may choose between two incommensurate options, but that to do so is normally to be asked to make an agonizing decision: "Having made certain agonizing choices we feel that we will never be the same again. We often refer to loss of innocence on such occasions."[12]

Now several issues spring to mind here. First, if 'incommensurate' really does mean 'incomparable', then why should we bring in a less widely recognized term rather than simply

---

[8]Ibid., p. 92.

[9]For Finnis's discussion of the survey of the ethics and cultures from which his seven values fall out, see ibid., pp. 83-85.

[10]Raz, *The Morality of Freedom*, p. 321.

[11]Ibid.

[12]Ibid., p. 340.

continue to use the more common term?[13] Secondly, Raz's definition is not easily usable since 'better' is a context-relative term: of any two things, A and B, we can normally say that one is better than the other only in a specified context.[14] Is admiring a beautiful painting better than providing emotional support to a friend? According to Raz they would appear to be incommensurate since we can neither say that one is better than the other nor can we say that they are of equal value. But if your friend is in dire need of emotional support, and you've just spent a week at the Louvre, then it seems pretty clear which is the better option. By Raz's definition, however, virtually everything appears to be incommensurate since nothing appears to be simply better than another, nor of equal value, in all contexts. Raz may, of course, quite easily escape this dilemma by choosing to apply the judgement of incommensurateness only in the framework of a contextually defined situation and not in the general case. Thirdly, the view that choosing between incommensurate options 'often' involves a wrenching loss of innocence appears to be rather overstated. Few of us will ever be asked to choose between divulging secret information versus facing exquisite torture leading to death. Many of us, however, will be asked "Will you have another coffee or shall we hop right along to the art gallery?".

Bernard Williams argues that comparisons between apparently incommensurate options must be possible, in a passage reminiscent of Finnis's expression of the importance of intelli-

---

[13]This is not to suggest that 'incomparable' is a philosophically simple term. The point is that, first, interchanging the two terms will tend to confuse, and, secondly, since 'incomparable' is more recognizable than 'incommensurable', we should use the former rather than the latter.

[14]In a similar vein we find the following: "No one can say "This is not as good as that," for everything proves good in its appointed time." Sirach 39:34, *The New English Bible*.

gent action:

> But unless some comparison can be made, then nothing rational can be said at all about what overall outcome is to be preferred, nor about which side of a conflict is to be chosen - and that is certainly a despairing conclusion. *Some* overall comparisons can be made, and if they can, then to some degree, it will be said, these values must be commensurable.
>
> The objection can be pressed further. When it is said that values are incommensurable, it is usually some general values such as liberty and equality that are said to be incommensurable. This seems to imply that there is no way of comparing or rationally adjudicating the claims of these values *wherever* they conflict. But no one could believe this, since obviously there are possible changes by which (say) such a trivial gain in equality was bought by such an enormous sacrifice of liberty that no one who believed in liberty at all could rationally favour it. So either it is false that these values are, as such, incommensurable, or incommensurability is a less discouraging or, again, deep feature than had been supposed.[15]

But this suggests implicitly what is explicit in Raz, i.e. that comparability and commensurateness are the same. At the very least Williams believes that comparability implies commensurateness, which is clearly stated in the second sentence of the passage quoted. But this supposition requires justification (and, by the way, it is not clear that Finnis must accept it either). Again the discussion seems to hinge on the problem of understanding the connection between commensurateness and comparability.

Williams' discussion does bring out the interesting fact that values like liberty and equality appear to be both incommensurate and non-comparable at the general level. In context, however, they appear to be commensurate and comparable[16] in the sense that, as he says, almost everyone judging a situation in which there is a wide imbalance between two

---

[15]Williams, *Moral Luck*, p. 77.

[16]Based on the last sentence of the passage quoted Williams seems to be non-committal as to whether these values are commensurate or, rather, that they are incommensurate but that incommensurateness is a less discouraging feature than had been supposed.

competing values (i.e., where foregoing a very large amount of value A would provide only a very small increment of value B) could quite easily reach the same decision. Interestingly, we see also in the passage that Williams is very much concerned that we should be able to rationally decide between conflicting claims, since otherwise nothing rational can be said about choice or preference. As a final point of interest note that the phrase 'to some degree' introduces us to the notion of degrees of commensurateness and incommensurateness, an idea that clearly differentiates Williams' notion of incommensurateness from the mathematical usage we examined in Chapter 1. As he says, incommensurateness would appear to be a less discouraging feature than had been supposed.

2.2 Finnis and incommensurateness - the critics

Russell Pannier continues the theme of identifying comparability with commensurateness,[17] arguing that Finnis cannot be right in maintaining the incommensurateness of basic values on the grounds that we can and do compare and choose among instances of these values. Pannier describes a situation of a person sitting down to a cup of coffee when he notices someone drowning in a lake. Pannier maintains that Finnis is forced to say that it is meaningless to ask whether it is preferable to abandon the coffee in order to effect a rescue, since the decision would require a choice between alternative and incompatible actions that exhibit values that are incommensurate with each other. But Finnis actually discusses an example much like this one and maintains:

But one can shift one's focus. If one is drowning, or, again, if one is thinking about

---

[17]Pannier, *Finnis and the Commensurability of Goods*.

> one's child who died soon after birth, one is inclined to shift one's focus to the value of life simply as such.[18]

As we saw with Williams, context seems to play a significant role in our ability to compare and to choose. It does not seem, however, that Finnis believes that comparability and commensurateness are equivalent since these kinds of cases provide examples where we may choose between incommensurate values, and, if our choice is to be a rational choice, we must be able to compare incompatible alternatives exhibiting incommensurate values. Note that this is not to say that *all* such situations must involve rational choice. Particularly in a case such as the ones mentioned by Finnis, one may be inclined, as he says, to shift one's focus rather than make a rational choice in the matter.

In the first of James Griffin's works[19] he attempts to demonstrate that we can, for any example involving a choice among competing and incompatible courses of action which exhibit purportedly incommensurate values, ask those with an interest in a situation to assign a monetary value to their interest in order to ascertain their distance from indifference. We can then, he suggests, make a calculation to arrive at a final decision as to what to do in that situation. He concludes that there are no incommensurate situations since we can always construct the methodology that will enable us to measure.

This approach, however, introduces some new considerations. First, Griffin's measure is clearly not objective, since it is, by definition, relative to the interested parties. Another example of the construction of such a measure is that used to score pentathletes and decath-

---

[18]Finnis, op. cit., p. 92.

[19]Griffin, *Are There Incommensurable Values?*.

letes who participate in various dissimilar events. Now this seems to be objective in one sense (i.e. it is well-defined and applied uniformly to all participants) but in another sense it is not objective insofar as it is, arguably, arbitrary and imposed. We have already seen, however, that measure is conventional, so that we may claim that the objectivity we seek is the former rather than the latter.

Some problems arise with the invention of such measures that are distinctly practical. In the case of Griffin's methodology, how are we to account for variations in the marginal utility of money among the interested parties? If we do not do so, all we are really doing is to allow those who care about money to win out in every situation, since such individuals will tend to show the greater 'distance from indifference'. Prior to this consideration, we need to determine how we are to determine who are the interested parties in a situation. Griffin's example is of a group of property owners and a railroad company, where the company wishes to lay track on a property adjacent to property owned by the property owners. He rightly includes as interested parties the railroad company, the property owners, and the people in the town which the track will ultimately reach. But the stockholders of the company have an interest here, as do its employees. So do environmental groups, some of whom prefer railway traffic to other forms of traffic as being less polluting, but some of whom are first and foremost interested in maintaining green spaces. Ultimately it is difficult to see how we are to reach agreement on all of these details.[20] It should be noted, however, that the fact that there are serious practical problems with the implementation of Griffin's methodology does not, by

---

[20]The issues associated with invented measures will be discussed further in section 2.4 of this chapter.

itself, demonstrate that the invention of a measure does not commensurate what were said to be incommensurate alternatives.

In a later work Griffin argues against the notion, expressed by Finnis, that to maintain that there are several irreducible human values is to maintain that these values are incommensurate. Griffin argues that the denial of reducibility is the denial that there exists a single super-value. However, he continues, this is not to say that there exists no single scale: "That is the ultimate scale here: worth to one's life."[21] He concludes that pluralism does not imply incommensurateness since we have a measure available to us: 'worth to one's life' is the measure that commensurates all of the human values. Finnis would argue that Griffin's measure is not valid since one cannot say that knowledge, for example, has a higher value to one's life than aesthetic experience. They both have the highest possible value in that no one would forego one in order to exclusively pursue the other. Griffin, presumably, would counter-argue that, in a given situation, one can determine a preference for one over another. Finnis could agree whole-heartedly, claiming that incommensurateness does not preclude comparability, so that in a given situation we are able to make a rational choice among competing alternatives which exhibit incommensurate values. Ultimately the resolution to the dilemma seems to lie in deciding at what level we are trying to ascribe incommensurateness: at the general level (the value itself) or at the situational level (the instance of the value in a specific context).

As we have seen, one tendency in the literature on the incommensurateness of values is

[21]Griffin, *Well-Being*, p. 90.

to equate incommensurateness with non-comparability.[22] Raz does so explicitly while Pannier and Williams do so implicitly. Let us consider first the ordinary language use of 'incommensurate' in a simple case (if, indeed, one may call any use of the term an 'ordinary language use'). A person's height and weight are incommensurate since there is no common measure available for measuring both.[23] And yet if we say of a person that he is heavier than he is tall, we know perfectly well what is meant. "That book was longer than it was good". "That car has better acceleration than it has brakes". Nor is this a particularly poetic way to speak. We simply mean that the characteristics being mentioned are in abundance on the one hand and relatively deficient on the other. In these cases, then, 'incommensurate' does not seem to imply 'non-comparable' since, even though we lack a measure, we are able to make comparative judgements with apparent ease.

Before entering a discussion of whether the basic human values are commensurate or incommensurate, we need to determine just what it means for a value-pluralist to maintain that there are various values. I take it that a value-monist maintains that there is a single value, be it goodness, pleasure, or whatever, and that a thing exhibits that value if it somehow demonstrates that value or participates in that value. A value-pluralist, by contrast, maintains that there is no single value, but, rather, that there are many. This brings up an obvious question: if there are multiple values, what is it about these values that justifies us in referring to them by

---

[22]The nature of this relationship will prove to be an important distinction, which will be discussed in some detail in Chapter 4.

[23]We ignore for now the issue as to whether a metric could be devised to measure both aspects. All that is maintained here is that no metric is available to measure both aspects, which for the present purposes may be read as "no such metric occurs to us".

the common label of 'value'? Further, if there is some common feature in which the various values participate, then what difference is there in saying either that there is only one value exemplified in various ways or that there are multiple values? And if they participate in some common feature, then why should they be incommensurate, since one might suppose that participation in a common feature should guide us to some common characteristic that can be jointly measured? I will not discuss the first two questions here, although they are interesting questions. The third question, however, needs some further elaboration.

Consider the notion of 'difficulty', which may be applied to a wide variety of tasks, say reading Hegel in German on a crowded subway during rush hour, or assembling a barbeque without the instructions. Which of the two tasks is the more difficult? For the engineer who designed the barbeque, the answer is probably clear. For others the answer is probably not clear. However, the question appears to be nonetheless meaningful. So we have here two contexts which are incommensurate in respect to difficulty, since there is no accepted measure to measure the degree of difficulty of the two situations. And yet we have a feature common to both, namely 'difficulty'. So participation in a common feature does not seem to imply commensurateness, at least in the case where we are comparing a single property exhibited by two different objects, since there are some properties where we do not seem to have the scale that enables us to measure effectively between two exhibitors of that property. This hearkens back to the discussion in Chapter 1 where it was suggested that some characteristics may be subjective to the extent that any hope of determining an effective measure appears to be doomed in certain cases.

Consider the more general question: "Is reading more difficult than assembling?" This general question does not seem to be easily answered. More information is needed before we can respond. Another situation of interest appears where the term in question is used in two clearly different senses. Which is harder, concrete or solving differential equations? Clearly the question can have no answer because it is deficient in some way. It is a zeugma, since the word 'hard' is used in two clearly distinct senses. Used of concrete, 'hard' refers to a physical property, for which physics provides a known scale. Used of solving differential equations, 'hard' refers to the degree of difficulty encountered by an individual in executing a mathematical process, for which we have no known scale.

In *Natural Law and Natural Rights* Finnis goes on to provide a detailed discussion of practical reasonableness, since this basic value is the one that guides our choices vis à vis the other values by helping us to decide what to do in our lives and how to go about doing it.[24] In some sense, then, it seems to have precedence over the other values since it is the one that determines which of the other values we will participate in at any time in our lives. It could be argued that life, another of Finnis's basic values, also has precedence, since it is the sine qua non of our participation in the other basic goods. The question arises as to whether this precedence of one value over another endangers the notion of incommensurateness. Ronald McKinney argues that it does:

> [T]he fact that Finnis claims that practical reasonableness is the one basic good which can never be excluded, even temporarily, also makes problematic his criterion of the incommensurability of basic values. For it would seem that, for him, practical reasonableness has priority over the others in so far as it is the virtue by which one shapes one's participation in the other basic goods.[25]

---

[24]Finnis, op.cit., p. 100.

[25]McKinney, "The Quest for an Adequate Proportionalist Theory", p. 63.

But unless McKinney is equating incommensurateness with non-comparability, this is a non sequitur. Life, I suppose, has priority over chocolate. And yet there is no measure available to allow us to measure both, so they are incommensurate in our terms. In any case, if McKinney is identifying incommensurateness with non-comparability, then there is a much more devastating question to raise against Finnis: how can practical reasonableness be the faculty that allows us to compare, contrast, and ultimately provide the framework for rational choice in our participation in the various basic values if those values cannot be compared at all? Assuming that Finnis does not suppose that incommensurateness necessarily involves non-comparability, however, there appears to be no inconsistency in allowing that one basic value may have precedence over another in some sense and yet maintaining that the two are incommensurate.

Is it possible for a person or culture to choose not to participate in one of the basic values and, if so, what would be the ramifications for Finnis's program? There is clearly some sense in which an individual may, at least superficially, make choices that ignore, or fail to recognize, any one of the values. The suicide declines to participate in life. But there are many explanations Finnis may avail himself of in this case: the individual may have opted for suicide, for example, because he or she has allowed practical reasonableness to be used to compare and contrast the value of terminating some overwhelming pain or suffering which the person is no longer able to endure. The hermit denies himself participation in the value of sociability, but if he denies himself, this may be seen as a recognition of the basic value itself, since we do not deny ourselves what we do not believe to be good.

McKinney argues that such situations are devastating for Finnis's program, citing as examples a scholar burning paintings to keep warm or a civilisation that declines to accept the value of religion:

> For Finnis himself claims to have derived his list of basic values for human flourishing from an empirical survey of cultures. If some culture lacks one of his seven basic values, it thereby eliminates such a value from being considered as basic according to Finnis' own methodology itself. Thus Finnis' theory, to be consistent, would seem to require that no one can choose not to participate in all seven of his basic goods. This because, for him, the alternative would be the sheer relativism deontologists attribute to proportionalism.[26]

But this seems to be plainly wrong. A scholar who burns paintings in order to keep warm may be seen as comparing the value of life with the value of aesthetic experience, and determining that life comes out on top. Finnis says that we can change our focus based on both internalities and externalities. As for the culture that declines to accept the value of religion, Finnis has at least two paths of argument. First, he may decline to accept the evidence that it does not value religion, especially since religion is, for Finnis, a very broad category and is not limited to the usual more limited conception of religion. Ultimately, however, if such a culture were really proved to his satisfaction to exist, he could still argue that this very fact suggests that members of the culture are not human in the same way as are we.[27]

2.3 Incommensurateness as the defining characteristic

While Finnis's critics do not seem to have successfully argued against his program, there is a further problem that does not seem to be discussed in the literature: the same kind of incommensurateness that Finnis asserts among the basic values also exists within each value.

---

[26]Ibid., p. 68.

[27]This would suggest that 'humanness', for Finnis, would be based not on a biological taxonomic definition such as 'member of homo sapiens', but would require 'humanness' to be defined in terms of an individual's participation in certain characteristic values.

How would I compare the devoted love of my wife with the long-standing affection of a dear friend (both being considered as instances of the value of 'sociability')? Or how would I determine the value of teaching my daughter to play baseball versus enjoying a game of snooker with my friend (both being considered as instances of the value of 'play')? There appears to be no common measure immediately available to us in these cases any more than in the previous cases in which the comparisons crossed boundaries between two of the basic values.[28] Not only do we not have a common unit of measure, in fact we do not have a unit of measure at all, evidenced by the fact that we do not, at least ordinarily, apply any unit of measure to instances of any of Finnis's values. In the example given above, that is to say, I do not normally assign x units of value z to teaching my daughter to play baseball and y units of value z to playing snooker with my friend. Yet there is still a basis of comparison, since I am able to make a decision as much in these cases as in the previous cases.

Incommensurateness may be less discouraging than had been supposed, as was earlier noted in a passage from Bernard Williams[29]. However, that passage indicates a further difficulty that needs to be pursued: while the concepts we are discussing here appear to be incommensurate, if not always non-comparable, in their specifics, they are both incommensurate and non-comparable when discussed as generalities. Is equality better than liberty? Is

---

[28]Again, this is not to say that it is impossible to devise such a measure. A measure here, however, would have two serious difficulties. First, it must allow for diminishing returns: the first game of snooker may have great value, the second may have some value, and the tenth may have negative value. Secondly, and following from the first point, the measure must be subjective: since 'value' can only be 'value to us', we are, therefore, the sole arbiters and administrators of this measure in our own case.

[29]Williams, *Moral Luck*, p. 76.

food better than drink? There seems to be no ready answer to the general question. The question is hopelessly lacking as it stands. In context, however, there may well be an answer. If someone is hungry, then that person should opt for food. If someone is thirsty, then they should go for the drink. In at least some cases, options that are in general non-comparable become comparable when we have a specific purpose or end in mind.

We saw earlier that Finnis makes no claim to having produced the ultimate list of human values: "There is no magic in the number seven."[30] So, if someone else has a list of eight values, then either the extra value is commensurate with one of Finnis's seven values or it is not. If it is not commensurate, then Finnis must accept eight values and admit that his survey was wrong. If it is commensurate, then Finnis cannot accept the eighth value, since incommensurateness is, for him, the defining characteristic of the original division. This is true whether Finnis is thinking of these values as seven categories or, rather, as seven dimensions of a human super-value. If they are categories, however, then Finnis needs to explain why, as we shall see in the next paragraph but one, some things appear to exhibit characteristics of more than one of these values. If they are dimensions, then he needs to offer a far more detailed account of how we can hope to make rational choices given that each option requires a calculation of up to seven independent, incommensurate vectors.

The matter becomes rather pricklier if it is correct to maintain that incommensurateness exists even within each of the seven values. If incommensurateness is the defining characteristic of the values, and if incommensurateness exists even within the values, then the whole division appears to break down and we are left not with the incommensurateness of seven

---

[30]Finnis, op. cit., p. 92.

values, but the incommensurateness of a universe of contexts and situations, real and speculative.

This may actually be more representative of reality, since this supposition readily allows for the cross-boundary content of much of our experience. Suppose that Dr. Livingstone, alone in the jungle, has set up camp and, late in the afternoon, is about to sit at a table he has set up in the shade of a banana tree. On the table are: a .303 rifle; Plato's *Republic*; a deck of cards; a portable tape player ready to play Verdi's Requiem; an unopened letter from a friend; a manual on jungle survival; and a bible. These objects are chosen to represent the seven basic values. However, any of the seven objects may have relations to values other than the one it represents. The gun, for example, represents life, protection of which is its obvious function. But a gun is an instrument of play to skeet shooters. It is an instrument of beauty to collectors. It embodies some knowledge of physics and chemistry. One requires practical reasonableness to use it responsibly. But if a tiger suddenly appears, the context of defence of life allows us to rapidly change our focus and to pick it up and aim.

As we saw earlier, Williams noted that where our options are weighted extremely unequally, we have no trouble choosing one of two incommensurate options over the other.[31] As he suggests, we would not expect a person to make an enormous sacrifice of liberty to gain a trivial increase in equality.[32] This is essentially the same situation as the choice of finishing our coffee versus rescuing a drowning man. We should think a person to be extremely hard

---

[31]Williams, again, is non-committal as to whether these options are incommensurate in a less discouraging sense or whether he denies that these options are incommensurate.

[32]Williams, op. cit., p. 76.

hearted who would not try to help a drowning man because he was enjoying his coffee so much. We should think him to be quite mad who tried to justify his lack of assistance on the grounds that he lacked a common measure to be able to make any decision to act at all. So, where the options are radically unequal, we do seem able to readily choose. Consider the choice between watching the Blue Jays play versus going to see Nancy Argenta sing Scarlatti arias, assuming that we would very much like to do both. When faced with such a decision we tend to consider a great many factors. The Blue Jays play every few days, while Argenta only rarely appears in Toronto. But perhaps the Jays game is the seventh game of the World Series. After due consideration, we do generally come to a decision, since we should think a person foolish to miss both events on the basis of being unable to make a decision for one over the other.

Consider now the choice between watching the Blue Jays play versus watching the Maple Leafs play, again assuming that we would very much like to do both. It is not at all clear that the considerations in this scenario differ from the considerations in the previous case. The situation is neither more nor less complicated. However, this does not necessarily demonstrate that the Blue Jays versus Argenta scenario does not involve incommensurate options. It may be the case that the Blue Jays versus Maple Leafs scenario also involves incommensurate options. We have no objective common measure for both of the two alternatives, since we have in fact no measure for even one. Note that this does not stop us from making a choice. Coins have varied uses, serving as legal tender, screwdrivers, etc. Very rarely do I see anyone flipping them to make decisions for hockey over baseball.

2.4 The invented measure

Various philosophers, most notably Bentham, have attempted to develop a calculus to allow us to measure and compare acts, generally moral acts. More generally, however, we need to ask whether it is possible, for any situation in which comparisons can be made, to devise a measure to allow us to measure two things to effect a measured comparison. To use an example already seen, given that we accept that one should be ready to put aside a cup of coffee in order to rescue a drowning child, is it always, or ever, the case that it is possible to devise a measure that allows us to measure the 'appropriateness' (in a sense that can, hopefully, be effectively defined) of both acts in question?

There do, in fact, appear to be cases where this devising of a measure in order to compare apparently unlike things has been done. In the decathlon, for example, athletes are scored on ten different events based on running, jumping, and throwing various objects. Marks are assigned for the various events and these marks are used to calculate an overall mark which is used to determine the winner. Now in our terms running, jumping, and throwing are not commensurate since there is not, already in common use, a measure that enables us to measure all three. Where there is no measure, the things are not commensurate. But does the invention of a ranking effectively commensurate them?

Now the first reaction to this example may well be to ask whether the scoring of the decathlon is done using simply the placement of the athletes in each event or, rather, using a system that accounts for the differences in attainment between one athlete and the next. The answer is, regardless of how it is done in reality, that it could be done either way. The first system is straightforward: if there are ten competitors we could, for each event, assign points from zero to nine, with the last place competitor receiving zero, the first place competitor receiving nine. Then we simply add the individual event marks to get the total mark. In the event that there is a tie, we may either accept that ties are possible, or determine some other procedure for breaking the tie. But we could also devise a ranking that accounts for differences in attainment: in the long jump, for example, we could assign zero for the last place competitor, one for the first place competitor, calculate the difference between the two jumps, and then assign numbers between zero and one to the other competitors based on the distance by which their jump beat the last-place jump, divided by the difference between the first-place and the last-place jump. Apparently the difference between the two rankings does not matter here as far as our abilities to use the rankings are concerned.

There is still the question, however, as to whether we may really call such an ordering a measure. If we think back to an example described in Section 1.1, we spoke there of seeing two structures in the distance, knowing that they are equidistant, but having no other visual cues to enable us to judge their heights. While we can compare the heights of these structures, and can, presumably, order then in height from tallest to shortest, we said that we could also agree to accept, say, the shortest of the structures as being equal to one unit and then measuring the other structures using this as our unit of measure. Further, since we chose to adopt a conventional view of measure, there seems to be no reason why we should not accept this as a being a perfectly valid measure.

One approach that I have heretofore avoided is to talk in terms of intrinsic and extrinsic metrics. This view would distinguish between measures that measure something intrinsic and common to both things being measured as compared to measures that do not. Two issues arise, however, with this distinction. First, we do not have an easy way to reach agreement on what is intrinsic to a thing, or even if anything really is so. Indeed, many would argue that there is *no* principled way to make this distinction. For example, we do, in general, expect to be able to measure the colour of cars and yet colour is, presumably, not intrinsic to a car, since it could be made, say, of clear plexiglass. Let us consider, then, a less stringent notion of 'intrinsic', say 'exhibiting a characteristic ordinarily expected to hold of such a thing'. But here the second issue arises: two things may ordinarily exhibit a characteristic in common that still does not offer an appropriate way to measure the two things. For example, the winning jump in both the standing broad jump and the running broad jump are determined by the length of the jump, which may be measured in feet and inches or in metres and centimetres, but neither of these measures offer an appropriate measurement to compare the two jumps (i.e., to compare one contestant's standing broad jump with another contestant's running broad jump). If our intent in measuring is to effect a comparison (which we saw in Chapter 1 is one of the key reasons for measuring), then this is not the appropriate way to measure, since the comparison would not normally be informative.[33] For these reasons I will avoid talk of intrinsic and extrinsic measures.

---

[33]That is to say, we would not particularly care that athlete A's running broad jump record surpasses that of athlete B's standing broad jump, since we would expect this to be the case. If, however, our purpose is to compare and contrast the usual records of the two kinds of events, then these data may be extremely informative, in which case our concern with the appropriateness of the measure is no longer an issue for us.

2.5 If not incommensurateness, then what?

I have argued so far that incommensurateness among the various basic values that Finnis proposes is a characteristic that is not useful, since it is a characteristic that also applies to instances within each of the seven values. But then it cannot contradistinguish those seven values since it does not give us seven values but a great many more. As per Figure 1, while we may accept that incommensurateness occurs between play and knowledge, it also occurs between hockey and baseball, so that it does not offer a defining characteristic that will allow Finnis to distinguish his seven values.

One question that then arises, however, is the following: if incommensurateness is not the characteristic that contradistinguishes Finnis's seven values, then what is? Now this question assumes that these seven values are distinguishable, but this seems like a fairly viable assumption. Each of Finnis's values does seem to strike us as describing groups of things that are important to us as human beings. Let us provisionally accept,then, Finnis's argument that his survey shows these features to be universal.

Our inclination in looking for the distinguishing characteristics of the seven values, however, need not be to look for unusual or exotic characteristics. Consider what are the distinguishing characteristics between hockey and baseball: hockey is played with so many players, on such a surface, and with a puck, while baseball is quite different in all these regards. Similarly, we may quite easily describe the differentiating characteristics between team sports and individual sports, and similarly between sports and board games (although the higher we go on the diagram the more abstract the defining characteristics become: for example, to distinguish between sports and other forms of play we need to appeal to the notion of family

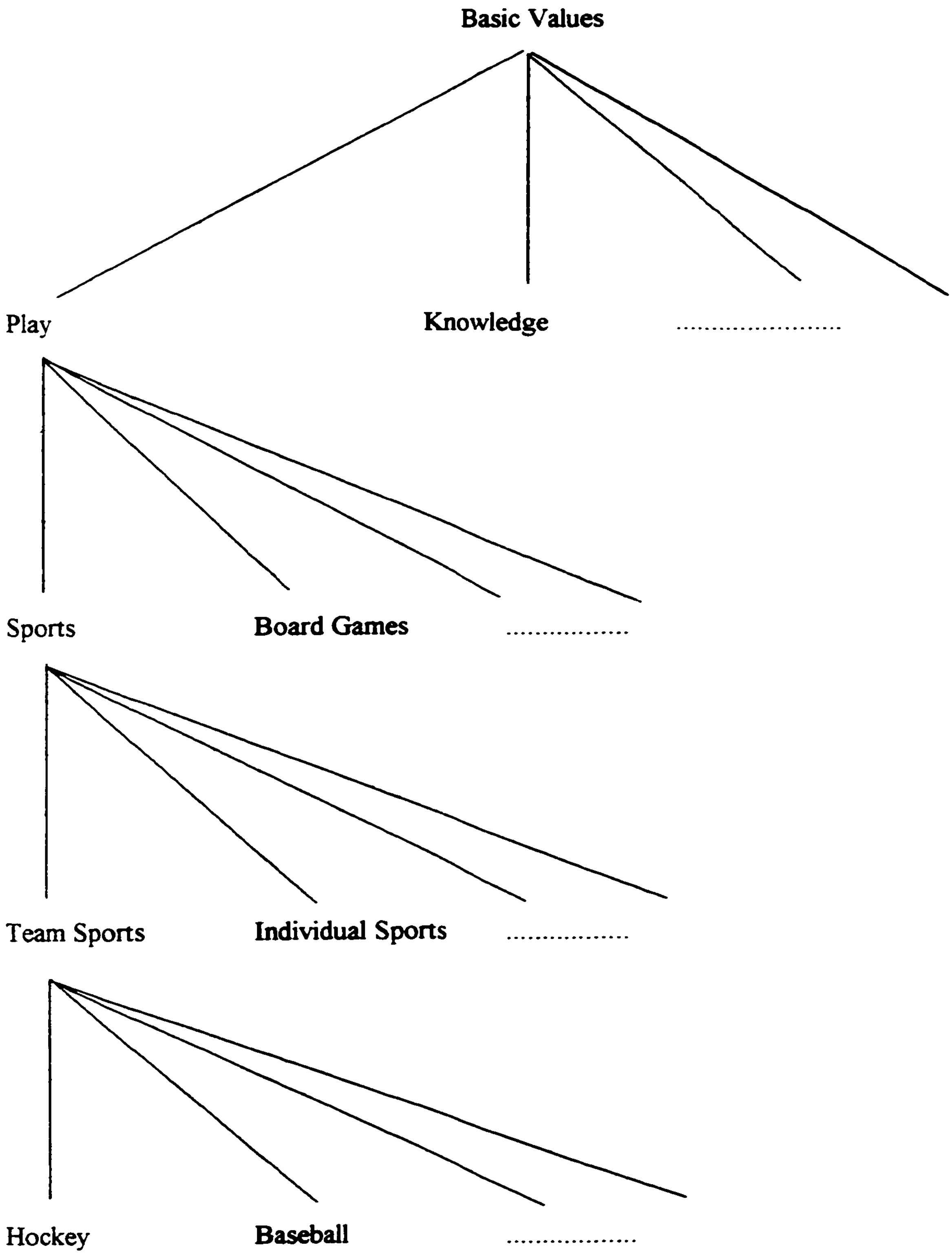
Basic Values
Play
Knowledge
....
Sports
Board Games
....
Team Sports
Individual Sports
....
Hockey
Baseball
....

Figure 1

resemblance groups, which, as a means of describing common characteristics, is rather less concrete than counting the number of players on a team).

In this way we see that there need be nothing mysterious about the distinction between, say, play and knowledge. What, then, differentiates these two? It is the way we define them that differentiates them. I will not attempt definitions here, but the fact that so many philosophical texts represent the attempts of leading philosophers to do exactly this sort of explication suggests that they believed the attempt to be viable.

Now we saw in the example of Dr. Livingstone that a situation or context may have in it elements of various of the seven values. Nor is there anything very surprising in this, since a single thing may be seen very differently in different situations. Also, many things fall squarely into two or more of Finnis's values. Is Bach's *Magnificat* aesthetics or religion? Presumably it is both. But is it, therefore, incommensurate with itself? Presumably Finnis will argue that its aesthetic character is incommensurate with its religious character, rather than supporting the notion that a thing may be incommensurate with itself. This seems reasonable if we keep in mind that incommensurateness is about things with respect to a specified property, as will be discussed in more detail in Chapter 4. Given this fact, there is no serious concern with the notion that different properties of a thing may naturally fall into different ones of Finnis's values.

It is difficult to look at Figure 1 and not to think in terms of types or categories. However, two cautionary notes are in order here. First, the diagram does not pretend to represent a complete ontology in any sense since there are many things that do not fall within the purview of human values. Most mundane objects, for example, while they may be of value to us for some specific purpose, would appear nowhere on a figure representing human values. Some non-mundane things would also not appear, such as the non-human moral values of an alien race living in another galaxy. Some non-existent things may appear on the diagram, such as 'perfect moral behaviour'. The chart, clearly, does not pretend to document everything there is. Secondly, the diagram does not purport to represent anything in the way of natural kinds. We have already seen that incommensurateness does not provide us with a clear differentiation among Finnis's seven values, and we cannot prove that there is anything special about those seven in the way of offering 'natural kinds'. Further, as we work down the chart we can see many other ways of dividing up the various elements (crosscutting the categories, as it has come to be called). Where we have divided 'Sports' into 'Individual Sports' and 'Team Sports', for example, we could as easily divide into, say, 'Winter Sports' and 'Summer Sports', in which case hockey and baseball would no longer be separate categories under a single heading but would now fall under separate headings. The chart, therefore, shows one way to categorize the realm of basic human values but can not be argued to be a 'natural' way, or a uniquely best way.

At some level I suspect that Finnis's categorization here is, under the surface, an appeal to a theory of natural kinds, which appeal does not hold up to close examination. There are places in his texts where one gets the impression that by 'incommensurateness' he really means just that the values are distinctive from each other, that they are independent of each other. This suggests that he is thinking of them as natural kinds, since they are not measurable by a common yardstick. But these values, while arguably distinct and, in some sense, independent, may only be said to represent 'conventional kinds', a term I think more descriptive than

Goodman's 'relevant kinds':

> In these latter cases, worlds differ in the relevant kinds they comprise. I say "relevant" rather than "natural" for two reasons: first, "natural" is an inapt term to cover not only biological species but such artificial kinds as musical works, psychological experiments, and types of machinery; and second, "natural" suggests some absolute categorical or psychological priority, while the kinds in question are rather habitual or traditional or devised for a new purpose.[34]

One obvious question that may be asked here is that, while 'sports' may be categorized as a 'team sport' rather than an 'individual sport', or, alternatively, as a 'summer sport' rather than a 'winter sport', what other way is there of categorizing human values? The answer is that we have already seen several. Maslow's hierarchy of human needs provides one such categorization. G. E. Moore's categorization, likewise referred to in the current chapter, provides another. Finnis himself refers to various other categorizations.

In answer, then, to the question as to what contradistinguishes the seven basic values, the answer is that we do by the way we categorize those values. And if we feel that knowledge and play, for example, are so different from each other that it is difficult to render judgements, particularly comparative judgements, about them, this is not very surprising. It is difficult in particular cases because, where both cases are important to us and there is conflict between the two, then we need to render a decision on two alternatives that share precious little as the basis toward a means of comparison. If the two alternatives shared a great deal in the way of a basis of comparison then they would not have been so widely separated on the chart. It is even more difficult to render judgements on two values in the abstract since we do not generally make comparisons of values at the general level but rather at the situational level.

---

[34]Goodman, *Ways of Worldmaking*, p. 10.

We do not usually attempt to decide whether play is better than knowledge, but, rather, whether we would prefer, at a given time, to play a round of golf or to read a book.

Interestingly, something like this concept of lacking sufficient commonality to allow comparison (notice again the subtle shift from commensurateness to comparability) is being seriously discussed in the most recent writings on incommensurability in ethics. Elijah Millgram, for example, defines incommensurateness as follows:

> Desires or ends are incommensurable when they do not contain within themselves the resources to resolve conflict between them into a judgement of relative importance or choice.[35]

In this case, however, incommensurateness comes to be a blanket term that describes any situation in which a decision on a choice of alternatives is less than clear. This happens in Millgram's case because he is ascribing incommensurateness of an entirely different class of things, viz., desires and ends rather than properties.

---

[35] "Incommensurability and Practical Reasoning", in Ruth Chang's *Incommensurability, Incomparability, and Practical Reason*, p. 159.

3.0 Kuhn and Feyerabend on theory choice

The most extensive, and probably the most confused, discussions relating to the notion of incommensurability have taken place in the wake of the writings of Thomas Kuhn and Paul Feyerabend. Kuhn's *The Structure of Scientific Revolutions*, first published in 1962, suggested that there were at least three reasons why revolutionary changes in scientific theories make it impossible for the proponents of the new and old theories to make complete contact with each other.[1] First, they will disagree about just what problems need to be resolved. Darwin's proponents, for example, maintain that the fossil record is a problem that must be resolved while, for the creationist, the same record is not a problem but, simply, a given. Relativistic physics does not permit resolution of energy without resolution of mass, since it interdefines the two. For other types of physics, however, the two may be seen as separate issues. Secondly, while the new theory generally borrows much of the vocabulary of the old theory, a change in the meaning of some words may have occurred. The term 'mass', for example, represents somewhat different concepts in relativistic physics and in classical physics, so that there is a serious potential for misunderstanding when proponents of the two theories try to

[1]Kuhn, *The Structure of Scientific Revolutions*, pp. 148-150.

communicate effectively.[2] Thirdly, the proponents of the competing theories see different things when they look at the world, i.e. the theory itself conditions the way the scientists see the world so that their very perception is influenced by the theory of which they are a proponent ('theory-laden' will be the term used to express this notion hereafter). As Kuhn has it, "Collectively these reasons have been described as the incommensurability of the pre- and postrevolutionary normal-scientific traditions...".[3]

Some commentators have suggested that Kuhn was arguing in the first edition of this book that all theory choice is irrational since, they argue, the proponents of opposing theories cannot communicate at all, given the three reasons specified above. This position, 'early-Kuhn', as we may call it, was a radical view for various reasons. Progress in science had largely been thought of as a cumulative progress, with the current breed of scientists standing on the shoulders of their predecessors, reaching ever new heights as they moved forward to the ultimate discovery of truth. For Kuhn, however, this view no longer held. Science, for him, was not necessarily cumulative, or evolutionary, but, at least some of the time, revolutionary. The scientists did not always stand on anyone's shoulders but would, perhaps, ultimately reject the very underpinnings and infrastructures provided by their predecessors. Far from moving forward toward the truth, Kuhn argued that there was no 'forward', since there was no way to justify one position as privileged over any other position. As for truth, well, the notion seems, for Kuhn, to be irrelevant. 'Early-Kuhn' was very much a radical position that changed the

---

[2]In many ways this is precisely the point that I am trying to make in this work: the word 'incommensurability' is dangerous because, while we may think we know what it represents, others may be associating with the term very different connotations than do we ourselves.

[3]Ibid., p. 148.

way that competing paradigms were viewed.

Kuhn revised this position in an appendix to the second edition of *The Structure of Scientific Revolutions*, arguing there that after a scientific revolution, while some of the vocabulary will have undergone a meaning shift, much of it will not have done so, and that sufficient common language remains to enable the proponents of the new view to discuss with, and ultimately to convince, the proponents of the old view that the new theory is an improvement over the old.[4] Ultimately, he argued, proponents of the old view may undergo a gestalt-switch experience in which they will grasp the new theory and will be able to internalize it, thereby becoming steadfast proponents of the new view and, as such, unable to return to their 'pre-gestalt-switch' views.[5]

Throughout this chapter I will distinguish between 'early-Kuhn' and 'later-Kuhn', the somewhat softened position of the 2nd edition of *The Structure of Scientific Revolutions*. In the 2nd edition Kuhn takes some philosophers to task for suggesting that his theory entails that the proponents of conflicting paradigms are not able to communicate with each other to such an extent that theory choice becomes irrational. Kuhn responds to this criticism as follows:

> Only philosophers have seriously misconstrued the intent of these parts of my argument. A number of them, however, have reported that I believe the following: the proponents of incommensurable theories cannot communicate with each other at all; as a result, in a debate over theory-choice there can be no recourse to *good* reasons; instead theory must be chosen for reasons that are ultimately personal and subjective; some sort of mystical apperception is responsible for the decision actually reached. More than any other parts of the book, the passages on which these misconstructions

---

[4]Ibid., pp. 198-204.

[5]Ibid., pp. 111-135.

rest have been responsible for charges of irrationality.[6]

If, as per later-Kuhn, he has been understood to mean that theory choice must be made 'without recourse to good reasons', then, he says, clearly the view that theory choice is wholly irrational in this sense is not tenable, at least in the world of science. Scientists do put forward reasons, hopefully good reasons, to support their theories: ability to make predictions, simplicity, generality, and so on. This assertion of 'irrationality', then, later-Kuhn claims not to have ever espoused.

A major concern with both editions of the book, however, is that Kuhn, while making use of 'incommensurability', never explains precisely what he means by the word. This is problematic particularly since there is no reason to suppose that he means anything even vaguely related to measurement. But if his usage is clearly non-literal he needs to explain it carefully. Since he does eventually describe what he means by 'incommensurability' in an article entitled "Commensurability, comparability, communicability", we will have to hold Kuhn to the view expressed therein coupled with the two editions of *The Structure of Scientific Revolutions*.

In the book Kuhn discusses some effects of incommensurability but, as mentioned above, does not explicitly discuss what incommensurability is and how it produces its effects. The notion of incommensurability is defined, finally, in the later work:

> The claim that two theories are incommensurable is then the claim that there is no language, neutral or otherwise, into which both theories, conceived as sets of sentences, can be translated without residue or loss.[7]

---

[6]Ibid., pp. 198-199.

[7]Kuhn, "Commensurability, comparability, communicability", p. 670.

So an implication of the incommensurability of two theories is that the language of neither of the two can be translated without loss or residue into the language of the other. Incommensurability then means that one cannot say precisely the same thing in both theories, that the granularity of meaning is different in the two cases so that we must always say more, or less, than what is expressed in the other theory. They are, ultimately, 'lacking a common language', and the problem is one of moving from one language to another language (which may be one natural language or more than one). And what does it mean for theories to be 'translatable'? We are told:

> For present purposes, then, translation is something done by a person who knows two languages. Confronted with a text, written or oral, in one of these languages, the translator systematically substitutes words or strings of words in the other language for words or strings of words in the text in such a way as to produce an equivalent text in the other language. What it is to be an "equivalent text" can, for the moment, remain unspecified. Sameness of meaning and sameness of reference are both obvious desiderata, but I do not yet invoke them. Let us simply say that the translated text tells more or less the same story, presents more or less the same ideas, or describes more or less the same situation as the text of which it is a translation.[8]

And again, more briefly:

> The translation consists exclusively of words and phrases that replace (not necessarily one-for-one) words and phrases in the original.[9]

Kuhn's notion of translatability, then, speaks of the possibility of providing 'equivalent texts' between two sets of sentences. While this equivalence is not necessarily a word for word equivalence between the two languages, it is not clear whether Kuhn believed there to be some limit on the complexity of one or the other of the expressions involved, i.e. either of the

---

[8]Ibid., p. 672.

[9]Ibid.

original expression or of the translated expression. Is it acceptable, for example, that the translated text of a single word should require ten words to 'tell more or less the same story'? What about one hundred words? Or one thousand? Additionally, the phrase 'tell more or less the same story' is problematic. While the passage suggests that more details will be forthcoming, this, unfortunately, did not apparently happen. In fact what it is for two texts to be equivalent will turn out to be quite problematic, since Kuhn will argue that, between paradigms representing conflicting revolutionary scientific theories, equivalent texts are not possible. But then, it would seem, we absolutely need to know how to recognise equivalent texts where they occur, and what level of precision we will require before we may allow that two texts are equivalent. If we cannot recognise equivalent texts, we appear to be no further ahead in recognising incommensurability between scientific theories, or even in proving that such incommensurability may exist.

In "Commensurability, comparability, communicability" Kuhn discusses two criticisms of his views. The first runs as follows:

P1 If theories are incommensurable, then they must be stated in untranslatable languages.

P2 If they are stated in untranslatable languages then they cannot be compared.

P3 If they cannot be compared then talk of evidence relevant to choice is incoherent.

C If theories are incommensurable, then talk of evidence relevant to choice is incoherent.[10]

---

[10]Ibid.

To this argument Kuhn again uses the defence that we earlier referred to, i.e., that only a small number of the terms have undergone a meaning shift and that, therefore, there remains sufficient common language for the discussion of differences and comparisons. In other words, he argues, premise two is not acceptable because, while the theories are untranslatable without residue or loss, they are yet comparable in some way due to the common vocabulary they contain.

The second criticism he responds to is that while he claims that it is impossible to translate old theories into the new language, it seems that people do so. But, Kuhn responds, people in fact do not and cannot translate, i.e. there is no set of expressions in the new language that can provide a text that is equivalent to, or, perhaps, synonymous with, the original expression of the old theory in the language of its time. He uses the example of 'phlogiston' which, he maintains, cannot be expressed in modern scientific language. The best one can hope to do is to immerse oneself in the culture of the science of that day so that one may 'go native' and so come to understand the meaning of 'phlogiston' as it was understood at the time that the concept was in vogue.

Kuhn makes much of the fact that terms in one natural language are often not translatable into another, such as the unitary concept expressed in French by 'doux', meaning 'soft', 'mild', 'harmless', and which is not expressible by any unitary concept in English. "Such words illustrate incommensurability between natural languages."[11] This disparate granularity is responsible for our inability to produce translations between natural languages without residue or loss. He would maintain, for example, that when we translate 'soft' into 'doux', we have

[11]Ibid., p. 680.

translated with residue. This is because 'doux', to the native French speaker, is tied up with several other meanings which are either unrelated, or at least less closely related, in English. The French speaker, then, brings with him this web of connections that the English author did not intend. Translating the same terms, but from French into English, would then be to translate with loss, since the French speaker expresses by 'doux' a richer web of connections than is understood by the English 'soft', and so the English translation loses certain associations that would be understood by the French speaker.

While this is reminiscent in some ways of Quine's comments on translation, especially in *Word & Object*, Kuhn explicitly rejects the Quinean view on the grounds that ignoring intension and focussing only on reference does not adequately distinguish between simple cases of ambiguity and cases in which different languages express unitary concepts differently, as in the case of the French doux/douce just mentioned:

> Quine's analysis of translation suffers badly, I think, from its inability to distinguish cases of this sort from straightforward ambiguity, from the case of terms like '*pompe*'.[12]

Now whether or not this is a valid criticism of Quine's program, the bigger question is whether a non-Quinean theory of meaning is required for Kuhn to maintain his views of meaning shift necessary to support his views on incommensurability. Put differently, does adoption of Quine's program, which obviates any theory of meaning, additionally obviate what Kuhn describes as incommensurability?

We have seen that incommensurability, for Kuhn, means 'lacking a common language',

---

[12]Ibid. 'Pompe' was given earlier in the passage as a case of simple ambiguity which may mean, in English, either 'pomp' or 'pump'.

or 'untranslatable', and that the mechanism that causes it is a shift in meaning that has changed the meaning of one or more key terms. Now clearly Quine's program does not eliminate this mechanism, since his program does not remove the possibility of the meaning shift of a term (which, for Quine, is to say, changes of reference of a given term). In fact the very phrase 'indeterminacy of translation' that has become so much associated with Quine is about nothing so much as the accounting for this mechanism that eliminates any possibility that two interlocutors can ever hope to be wholly assured of synonymy: "The very question of conditions for identity of propositions presents not so much an unsolved problem as a mistaken ideal."[13] This is also, of course, Quine's answer to Kuhn's permanently postponed question as to what it would mean to have two equivalent texts: for Quine we cannot answer the question because the radical indeterminacy of translation precludes, not just our knowing the answer to this question, but the possibility of such a thing being the case at all.

Does this, then, eliminate Kuhn's problem? Do we, and Quine, simply maintain that Kuhn's expectations are too great in expecting translatability? In one sense it does: Kuhn wants 'incommensurability' to mean 'untranslatable without residue or loss' while in Quine's program we have no mechanism that would enable us to make such a determination. Since the problem cannot arise in Quine's program, the problem may be said to be resolved. For Quine, then, Kuhn's problem is no problem. On the other hand, Quine's program does not eliminate Kuhn's problem since no doubt Kuhn does not expect that two proponents, even of the same theory, would have intensional equivalence of key terms of the theory in question and he would argue that he requires, so far, only that two equivalent texts 'tell more or less the same story'.

[13] Quine, *Word & Object*, p. 206.

Kuhn's views on incommensurability are all about, first, recognition of a radical difference in meaning and, secondly, the possibility of continued intelligent discussion between proponents of different theories once this meaning shift has been recognised. Whether we adopt a referential theory of meaning or maintain some focus on intension, this remains a problem. A key difference, however, is that Quine's program offers several potential definitions of synonymy[14] while Kuhn has yet to explain what are to count as equivalent texts. Moreover, this is a serious deficit in Kuhn's program: since incommensurability is defined by Kuhn as 'untranslatable without residue or loss', the criteria for evaluating our ability to effect such a translation is paramount, else we cannot identify incommensurability where it exists. And to suggest that any reasonable account of 'equivalent texts' will suffice is hazardous since the phrase 'untranslatable without loss or residue' suggests a level of precision which may not be available to us. We will see throughout the chapter that Kuhn maintains a precarious balancing act, trying to maintain, on the one hand, that equivalent texts between incommensurable paradigms are not possible, while maintaining, on the other hand, that intensional equivalence is not a requirement, in that equivalent texts need only 'tell more less the same story'.

The second objection that Kuhn responds to in "Commensurability, comparability, communicability" is that the theories that he claims are incommensurable cannot be so since they have in fact been compared. His defence here is that incommensurability does not, in the mathematical case, imply non-comparability and that it should not imply non-comparability in his sense either. After giving a brief summary of what 'incommensurability' signifies in

[14]See for example his definitions of structural synonymy (*Word & Object*, p. 204) and of stimulus synonymy (*Word & Object*, p. 46).

geometry, Kuhn says:

> Applied to the conceptual vocabulary deployed in and around a scientific theory, the term 'incommensurability' functions metaphorically. The phrase 'no common measure' becomes 'no common language'. The claim that two theories are incommensurable is then the claim that there is no language, neutral or otherwise, into which both theories, conceived as sets of sentences, can be translated without residue or loss. No more in its metaphorical than its literal form does incommensurability imply incomparability, and for much the same reason. Most of the terms common to the two theories function the same way in both; their meanings, whatever those may be, are preserved; their translation is simply homophonic. Only for a small subgroup of (usually interdefined) terms and for sentences containing them do problems of translatability arise. The claim that two theories are incommensurable is more modest than many of its critics have supposed.[15]

First of all, then, it appears that Kuhn is basing his usage on the mathematical usage rather than the etymological usage, and that his concern is with expressibility rather than measurability. Just as the irrationals cannot be expressed as the ratio of two integers, it seems, so certain terms in one theory may not be expressible using the terms of an incommensurable theory.[16] But by itself this suggestion is not a sufficient defence of the comparability of incommensurable paradigms, since he is using, by his own admission, 'incommensurability' in a usage that is metaphorical. And yet we know that attributes that apply to any word in its normal usage do not necessarily apply to any metaphorical usage that is parasitic on the normal usage, and while he maintains that comparability as a characteristic will flow in his metaphorical use "for much the same reason", it is not yet clear in what this commonality of reason consists.

Feyerabend, who claims to be largely in agreement with Kuhn, seems to be at times

---

[15]Kuhn, *Commensurability, Comparability, Communicability*, pp. 670-671.

[16]For Kuhn it is clear that 'incommensurable' and 'incommensurate' are equivalent terms, since he maintains that it is not possible to express the key terms of one theory in the language of an incommensurate theory. For this reason the two terms are used interchangeably in this chapter.

more extreme than Kuhn and at other times to be less so. He asserts that Putnam's claim, that incommensurability means non-equivalence of unitary terms, is wrong:

> [Incommensurability] occurs only when the conditions of meaningfulness for the descriptive terms of one language (theory, point of view) do not permit the use of the descriptive terms of another language (theory, point of view); mere difference of meanings does not yet lead to incommensurability in my sense. [17]

So, for Feyerabend, apparently, lack of synonymy does not imply incommensurability. This is an important clarification since Kuhn seems to suggest that the use of the French term 'doux' represents an example of incommensurability between French and English. This view is somewhat difficult to rationalize, since our ability to 'tell more or less the same story' does not seem to be adversely affected and, if incommensurability implies that we cannot do this, then we seem to find here a counter-example since Kuhn maintains that this example, which appears to be translatable, is also incommensurable. Now Kuhn will argue that the word is not translatable 'without loss or residue' in some technical sense, as per our earlier discussion, but he would be hard pressed to argue that one cannot provide a translation that tells 'more or less the same story', especially since he declines to place a limit on the complexity of the expression we can use to translate a single word. Back to Feyerabend, we find that he, unfortunately, does not make explicit for us what these 'conditions of meaningfulness' are. Presumably he would not argue that these are the conditions by which we determine translatability, since it is, ultimately, translatability that we are trying to determine. But what, then, are the conditions? We are left, unfortunately, in the dark.

Another claim made by Feyerabend is that "...successive incommensurable theories are

[17] Feyerabend, *Putnam on Incommensurability*, p. 81.

related to each other by replacement, not by subsumption".[18] But the move from Ptolemaic to Copernican theory, which is clearly a case of replacement rather than subsumption, does not meet Feyerabend's criteria of incommensurability, since there does not seem to be any meaning shift that has occurred in any of the terms that cannot, quite easily, be described in the language of the new theory, and so the 'conditions of meaningfulness', presumably, will permit the continued use of the descriptive terms.[19] Feyerabend may, of course, deny that the Ptolemaic and the Copernican cosmologies are incommensurable, since he has nowhere said that theories related to each other by replacement are necessarily incommensurable (i.e. replacement is a necessary, but not a sufficient, condition of incommensurability).

3.1.1 Commentaries on 'translatability' and 'meaning shift'

There are three major themes of criticism directed against Kuhn's and Feyerabend's view of incommensurability as it relates to theory choice. The most prominent in the literature is the one that relates to translatability and meaning shift, which will be examined in this section. The next section will discuss concerns that the view is self-contradictory. The third theme of criticism, discussed in Section 3.1.3, is that in regard to the notion of the gestalt switch.

There are those who are entirely comfortable with the notion that meaning shift does regularly occur in moving from one theory to another, that incommensurability therefore exists,

---

[18]Feyerabend, *Against Method*, p. 212.

[19]This case will be further discussed in Chapter 4. The key issue is whether meaning shift occurs where the object in question has been re-categorized, and whether the meaning of a word includes all of its relationships.

but that we can nevertheless expect to retain sufficient common language to allow the proponents of the opposing theories to discuss their relative benefits and to ultimately reach a conclusion. Joseph Margolis relies on the notion of degrees of translatability and of degrees of comparisons of commensurability, which, I think, must also imply degrees of commensurability and, hence, must also imply degrees of incommensurability:

> Translation and comparisons of commensurability are always and only matters of *degree*, and are normally quite intuitively managed. There is nothing wrong at all with the idea of the relative success of the translation of incommensurable schemes. Nothing at all. Hence, *moderate incommensurabilism is quite viable conceptually and forms an important family of relativisms.*[20]

We can imagine, for example, that if two people set out to translate a passage of literature from one language to another, we may well decide that one translation is better than the other and that neither was wholly felicitous. As Margolis says, this notion of the relative success of translation does not seem unduly troubling.

While some, like Margolis, have been supportive of Kuhn's works, many opponents have been extremely harsh. Quite common in the literature is a tendency to attack early-Kuhn and to ignore his later clarifications. Howard Sankey, for example, writes:

> As it is generally understood, the incommensurability thesis combines these three claims. It is the thesis that the languages of some scientific theories are, at least in part, mutually untranslatable, and consequently there are not logical relations between them and their content is incomparable.[21]

While this was, at least approximately, a summary of early-Kuhn, later-Kuhn asserts both that there can be logical relations between incommensurable theories and that comparability is not

---

[20]Margolis, *The Truth About Relativism*, p. 107. Italics denote underlining in the original.

[21]Sankey, *The Incommensurability Thesis*, p. 2,

necessarily compromised by incommensurability. While Sankey's summary may be approximately true of early-Kuhn, it is not representative of later-Kuhn (although later-Kuhn maintains that even early-Kuhn never suggested that comparability was compromised). In any case it seems simple to demonstrate that Sankey's summary of the radical view is in error: the Ptolemaic and Copernican cosmologies offer incompatible theories which explain and predict a, largely, common set of observable events. Their efficacy in predicting some specific, observable event may be compared. If we accept that such a comparison is evidence of comparability of content, then their content is not incomparable. If we do not accept that such a comparison is evidence of comparability of content, then we need to explain what would offer such evidence. Given that comparability, in general, is comparability of a property for a defined purpose, then what property of the two cosmologies in question can be said to be non-comparable? Sankey's argument only seems viable against what would seem to be a deeply flawed view.

Sankey goes on to argue that comparability between theories is possible if there is sufficient referential overlap between the terms in which meaning shift has occurred.[22] By 'referential overlap' we refer to that part of the meaning that has remained unchanged even though we acknowledge that some meaning shift has taken place. The term 'mass' in relativistic physics, for example, Sankey would argue, contains enough of what 'mass' meant in classical physics for us to recognise some commonality between the terms. This commonality is referred to as 'referential overlap', and, Sankey argues, it affords us an avenue to compare

---

[22]Although not explicit, a similar line of argument may be found in Scheffler's *Science and Subjectivity*, p. 126.

the different usages. This argument also appears in Devitt, who argues that incommensurability does not occur since untranslatability does not occur; this because the reference change that takes place always retains sufficient referential overlap to allow for comparison: "...theory comparison is possible even where there is radical reference change."[23]

Bjorn Ramberg argues that Devitt has done something of note, but that it is not what Devitt thought he was doing. Ramberg claims[24] that Devitt is right in arguing that meaning change does not preclude comparability, but that this does not at all preclude incommensurability since, he claims, incommensurability isn't really what everyone thought it was in the first place. Ramberg's views are more fully discussed in the Appendix.

Jaako Hintikka argues[25] in a similar vein that translatability cannot be a condition of commensurability since incommensurable theories have in fact been compared, suggesting that he too supposes, at least, that incommensurability entails non-comparability. He also goes on to suggest that incommensurability is a very different sort of thing than we all thought. Hintikka's views also are more fully discussed in the Appendix.

Another concern with the notion of meaning shift is how it can occur in the first place. If a term in a theory has a certain meaning which is conditioned by the theory built up by the scientists themselves, then how can any meaning shift take place at all? That is, if our observations are theory-laden, then how is it possible to conceive of change to the theory?

---

[23]Devitt, *Against Incommensurability*, p. 48.

[24]Ramberg, *Donald Davidson's Philosophy of Language*, p. 117.

[25]Hintikka, *On the Incommensurability of Theories*.

Mary Tiles has described[26] a scenario put forth by Bachelard, which maintains that science takes place at two levels. At the informal level scientists make observations, construct hypotheses to explain the observations, and devise experiments to test the theory's ability to explain and predict. They then construct theories at the formal level which attempt to axiomatize the theory and to create an objectivized view with well-defined concepts. Now conceptual change at the formal level is not possible since the terms are defined by the formal language around them. Conceptual change may well occur at the informal level, however, which may then be tested, and ultimately axiomatized at the formal level as a rival theory which may then subsume or replace the original theory. Incommensurability may then occur at the formal level since there may not be translatability of the terms of one theory in the language of its rival.

3.1.2 The 'self-contradictory' critique

The second major criticism of the incommensurability thesis as put forth by Kuhn and Feyerabend is that the theory suffers from internal contradiction. Paul Hoyningen-Huene maintains, first, that Kuhn requires a theory of world constitution. He argues[27] that, if the world itself changes as a result of a scientific revolution, then precisely what constitutes the world must be specified. Further, he maintains that this theory of world constitution must be a general theory and not specific to any individual case. However, he continues, this is not possible since part of what constitutes the world is its relationships, including its relationships

[26]Tiles, *Bachelard: Science and Objectivity.*

[27]Hoyningen-Huene, *Kuhn's Conception of Incommensurability*, pp. 490–492.

with observers. Since the observers are individuals, any theory of world constitution is specific to individuals. Therefore, he concludes, Kuhn's notion of incommensurability is internally deficient since a general theory of world constitution is not possible. In any case, he notes, there is not any obvious way to cast off our established views, i.e., there is no obvious way to view the world in a way that is not theory-laden with whatever theory we have internalized.

There seem to be several avenues open to Kuhn to respond to this argument. First, he could maintain that he is speaking only non-literally of different worlds. While this seems sensible, Kuhn does not appear to be speaking non-literally here. Secondly, Kuhn could make use of the widely used device of differentiating between the world-in-itself and the world-as-perceived. In this case the occurrence of a scientific revolution would change one world without changing the other. It is not clear whether this is a defence that Kuhn would want to use, since in his talk about how paradigms change the world it appears as if Kuhn wants to have it both ways. While he does, as we shall see, say that the world itself does not change as the paradigm changes, he also claims that the only world that matters is the conditioned world, the world as perceived:

> In so far as their only recourse to that world is through what they see and do, we may want to say that after a revolution scientists are responding to a different world.[28]

So, does Kuhn really distinguish between 'change of the world' and 'change of view of the world'? It appears that he does and, if this is true, then Kuhn can readily explicate for Hoyningen-Huene what it is that describes, for any paradigm, what constitutes the world, since the paradigm itself may be seen as the world view for that paradigm. For Kuhn, the paradigm

---

[28]Kuhn, *The Structure of Scientific Revolutions*, pg. 111.

is the world view. Thirdly, Kuhn may argue that the fact that part of what constitutes the world is its relationships with observers does not preclude the possibility of providing a general theory of world constitution. It is difficult to imagine a general theory of diving boards without making reference to a diver, but the fact that the diver is ultimately an individual does not make the theory dependent on any particular diver. The analogy is not, of course, complete since in the diving board example the diver is not part of the board in the way that the scientist is both an observer of the world and part of the world, but it is not clear why a general theory of world constitution may not consistently allow for observers who are part of the world and yet not commit itself to any specific individual. As to Hoyningen-Huene's note that we have no obvious way to cast off our established view of the world, this is neither here nor there since, evidently, it does happen, else changes in scientific theories would not occur. In fact I suspect that Kuhn would agree wholeheartedly with this comment and maintain that it demonstrates precisely the difficulty that proponents of the old paradigm incur when faced with a revolutionary change in their field of practise. In fact, Kuhn makes clear in several places that the stages leading to revolutionary change are, generally, invisible, and that we are not aware of such a change taking place.

Derek Phillips' argument[29] here is relatively simple: Kuhn cannot argue that his theory of paradigm shifts is the 'right' way to view the philosophy of science since it forms its own paradigm which is one of, perhaps, many incommensurable ways of viewing the subject. Here again Kuhn has several lines of defence open to him. First, if he is a good scientist, he will

---

[29]Phillips, *Wittgenstein and Scientific Knowledge*. Also put forth in Scheffler, *Science and Subjectivity*.

immediately agree that his theory is not necessarily put forth as 'the right theory', holding some privileged position over all competing theories. But scientific theories do not have to be right; they only have to be better in some ways than the theories with which they compete. Secondly, Kuhn, particularly late-Kuhn, should be quite comfortable with the notion that his metatheory creates its own paradigm. But just as scientific theories that deal directly with the world contain sufficient common ground to allow scientists to persuade, compare, and contrast, and ultimately to judge and to accept or reject the new contender, so should his contender be able to be compared, contrasted, and ultimately judged as to its relative merits vis à vis other theories of theories. What we do not have from Kuhn is a generalized theory of how scientists determine preference for one paradigm over another, but it is not clear that Phillips has demonstrated any want of internal consistency in the notion of a paradigm.

Michael Bishop's argument is rather more subtle:

> Only if our conceptual resources are radically circumscribed by the theories we believe will it be impossible for proponents of competing theories to share a common observational language.[30]

However, he continues, proponents of the incommensurability thesis maintain that it is possible to go native and so to approach a common observation language. But in that case our conceptual resources are not in fact radically circumscribed by the theories we believe. Therefore, the thesis is self-defeating.

This argument seems flawed, however, since Kuhn, I believe, would neither accept that there is, nor that there can be, any shared observational language. Scientists of competing paradigms see different things when they look at the world, i.e. their observations are theory-

---

[30]Bishop, *Why the Semantic Incommensurability Thesis is Self-Defeating*, p. 354.

laden. Kuhn would maintain, against Bishop, that the ability to see the world through different paradigms, i.e. the ability to go native, does not provide a *common* observational language, any more than a person who speaks two natural languages has found some independent common language. It means that he can see the world from two different theory-laden perspectives. And if we cannot approach a common observational language, then Bishop's argument fails, since it is on the basis of the existence of this common observational language that he concludes that the incommensurability thesis is not consistent.[31]

Ultimately, the problem which Kuhn leaves us with is not simply that our theories change our perspective on the world. The more basic problem is that this is all that we have access to. The problem is not, in Kuhn's terms, a problem of intension but, in Goodman's terms, a problem of worldmaking. Theory-ladenness, for Kuhn, is not simply a factor of meaning but also of ontology, since 'the world' is ultimately, for each of us, 'the world as perceived'. This view runs as an undercurrent throughout Kuhn's writings, as we saw a few pages back and as can be seen from this passage:

> ...though the world does not change with change of paradigm, the scientist afterward works in a different world.[32]

While the world may have an objective existence, there is, for us, only 'the world for us'. This poetic language is difficult to understand. To say that the world does not change but that it is yet a different world seems impossible, since if it does not change, then it cannot be different,

---

[31]This is not to suggest that the individual who can see the world through different paradigms is unable to recollect all experiences from one paradigm while currently experiencing through the perspective of the competing paradigm. However, Kuhn would argue, he cannot adequately express his experience of the one paradigm in the language of the other.

[32]Kuhn, *The Structure of Scientific Revolutions*, 2nd edition, p. 121.

since different here must mean 'different from what it was', and yet we have been told already that it did not change. This notion of the world being theory-laden is at least as old as Laurence Sterne's description first published in 1761:

> The truth was, his road lay so very far on one side, from that wherein most men travelled, - that every object before him presented a face and section of itself to his eye, altogether different from the plan and elevation of it seen by the rest of mankind. - In other words, 'twas a different object, - and in course was differently considered.[33]

This response, however, that there is no common observational language between proponents of competing paradigms, while available to Kuhn, brings up another potential problem for him that has already come up: if our conceptual resources are radically circumscribed by the theories we believe, then how is it possible for an individual to conceive of any new scientific theory at all? The common sense view seems to be that our conceptual resources are not radically, but only somewhat, circumscribed by the theories we believe. This, is a view that fits comfortably with Ramberg, and perhaps Devitt and Scheffler, resulting from the notion that, while wholesale meaning shifts do occur, partial referential overlap remains. As a result we would expect to find that proponents of competing incommensurable theories would still share some commonality in their observational languages.

3.1.3 Commentaries on 'gestalt-switch'

The third, and final, class of commentaries on Kuhn's views are those concerned with

---

[33]Laurence Sterne, *The Life and Opinions of Tristram Shandy, Gentleman* (Harmondsworth: Penguin Books, 1967, p. 375). Interestingly Sterne goes on in this passage to relate this discussion to value: "This is the true reason, that my dear Jenny and I, as well as all the world besides us, have such eternal squabbles about nothing. - She looks at her outside, - I, at her in - . How is it possible we should agree about her value?"

his notion of the gestalt-switch. Kuhn maintains that a scientist who has internalized two competing incommensurable paradigms is able to understand the two views, but, at some point, commits to the new view. This conversion to the new paradigm is referred to as a gestalt-switch.[34] Kuhn likens the experience to looking at a duck-rabbit drawing, which may be seen alternatively as a duck or as a rabbit, depending on how one interprets the ambiguous figure. The difference between such a drawing and scientific theory choice is that, in the latter case, there is no external reference available to us. In speaking of the cases of both the duck-rabbit drawing and the anomalous card experiment (wherein a subject is shown, for short periods, cards with, say, black hearts, or red spades), Kuhn says:

> In both these cases, as in all similar psychological experiments, the effectiveness of the demonstration depends upon its being analyzable in this way. Unless there were an external standard with respect to which a switch of vision could be demonstrated, no conclusion about alternate perceptual possibilities could be drawn.
>
> With scientific observation, however, the situation is exactly reversed. The scientist can have no recourse above or beyond what he sees with his eyes or instruments.[35]

Kuhn appears to suppose that a scientist will support, and argue for, one complete paradigm over another, although it is not clear that there could not be a case where one paradigm was superior for certain kinds of problems while another paradigm was superior for a different set of problems.

---

[34]Kuhn is not entirely clear on just what is happening here. While the scientist can recognize his discarded paradigm, and reject it, Kuhn also suggests that the scientist cannot switch back and forth between the two paradigms. See *The Structure of Scientific Revolutions*, 2nd edition, pp. 114-115.

[35]*The Structure of Scientific Revolutions*, 2nd edition, p. 114.

Phillips[36] picks up the duck-rabbit drawing analogy, maintaining that we do not find a reason to posit incommensurability in that case. Therefore, he concludes, there seems to be no reason to posit incommensurability in the case of opposing scientific theories. But this argument does not stand up to a closer examination. Incommensurability, for Kuhn, refers to the inability to provide a complete translation of one theory in the terms of another, as well as the inability to translate both into a third, common, language. Incommensurability then leads to the requirement for the gestalt-switch, since one can view the world through only one conditioned view at a time, since, being incommensurable paradigms, they are incompatible at some level. Phillips, however, argues that since the two perspectives of the duck-rabbit drawing require the gestalt-switch, they must therefore be incommensurable in Kuhn's theory. The argument is this:

P1 Incommensurability (so Kuhn claims) requires a gestalt-switch.

P2 The duck-rabbit drawing requires a gestalt-switch.

IC Therefore the two perspectives of the duck-rabbit drawing are (in Kuhn's view) incommensurable.

C But the intermediate conclusion is wrong, therefore there is no reason to posit incommensurability in the case of opposing scientific theories.

But using P1 and P2 to prove IC is an invalid mode of argument. Whether Kuhn supposes that the duck-rabbit drawing offers incommensurable perspectives or not, Phillips' argument seems to be lacking.

Phillips also suggests that, while Kuhn's paradigms are closed systems consisting of

---

[36] Phillips, *Wittgenstein and Scientific Knowledge*.

tight consistent belief structures, we don't live in a world like that. Our belief structures tend to overlap, to be inconsistent, to be ragged and ill-defined. Further, he argues, the relative benefits of competing paradigms appear to be discussed and debated over extensive time periods, not looking revolutionary at all. He makes the point that even political revolutions are not really that revolutionary, with long gestation periods, perhaps a defining period, followed by a long period of adjustment.

It looks here, however, as if Phillips has drawn an analogy and tried to run too far with it. No doubt we do not, at least most of us, live in tight consistent paradigms. But Kuhn is not talking about everyday life but about theory choice in science. And in science, he could argue, we do indeed look for tight consistent belief structures. In fact he spends considerable time explaining what he means by 'normal science', which is most of what science does: it is the painstaking work of making one's paradigm tight and consistent, to try to fit the world to the paradigm. As to the notion that scientific revolutions do not happen overnight, this only suggests that scientists do have to struggle to come to terms with a new structure that is so entirely at odds with the one with which they are familiar. And if even political revolutions happen slowly, why, then, should scientific revolutions be any different?

Scheffler's concerns with Kuhn's views on the gestalt-switch theory[37] revolve around Kuhn's tendency to talk as if this switch is an indicator that scientific revolution has occurred and that 'normal science' is not in a position to comment: "Paradigms are not corrigible by normal science at all."[38] says Kuhn. Scheffler is decidedly at odds with this view. He points

---

[37]Scheffler, *Science and Subjectivity*, p. 127.

[38]Kuhn, *The Structure of Scientific Revolutions*, p. 122.

out that we simply do not see scientists using talk of paradigms to justify their acceptance of new theories, which is presumably what they would have to resort to if 'normal science' were really unable to comment. If we side with Kuhn, however, he may mean here only that the normal science of the displaced paradigm is not in a position to correct the new paradigm since it, by definition, has not understood, or gone native to, the new paradigm. This is supported by the sentence immediately prior to the sentence just quoted, in which Kuhn asserts that normal science "can only articulate a paradigm, not correct it".[39] Normal science, it seems, can only work within the confines of the paradigm in which it is 'normal', and is not, according to Kuhn, able to render judgements on incommensurable paradigms for which it is, by his definition, not normal, since normal science is science working within the confines of a paradigm. Interestingly, then, normal science is not the aspect of the scientific process that enables choice among various competing paradigms. Note in Kuhn's defence, however, that this does not lay him open to charges of irrationality since he does not assert that there are *no* rational processes at work in this choice; he merely defines 'normal science' in such a way that it becomes clear that this is not the process at work in theory choice.

3.2 Attributes and non-literal usage

Kuhn's view of incommensurability as 'lacking a common language'[40] has, as we have

---

[39]Ibid.

[40]I use the phrase 'lacking a common language' in contrast to the etymological use of incommensurability as 'lacking a common measure'. Kuhn's actual words are: "Applied to the conceptual vocabulary deployed in and around a scientific theory, the term 'incommensurability' functions metaphorically. The phrase 'no common measure' becomes 'no common language'." ("Commensurability, Comparability, Communicability", p. 670.)

seen, been widely criticized in the literature, but has never been struck a fatal blow. As recently as 1997, for example, Stephen Leeds, writing in *Noûs*, claims that

> ...there is, I suspect, a fairly widespread agreement that, at least on some plausible ways of understanding what it is for two theories to be incommensurable, there will be some genuine cases of incommensurable theories - though perhaps not as many as once was thought.[41]

Clearly the critics of Kuhn's notion have not yet been fully convincing. A common characteristic in many of the writings of these critics has been the failure to discuss the relationship between the notions of commensurability and comparability. Hintikka, among others, is very quick to assert that these two notions are equivalent. When the distinction is denied, Kuhn smoothly points out that incommensurability, in its mathematical usage, does not imply non-comparability. At its root, and rather oversimplified, a popular critique of Kuhn runs as follows:

> The two theories (that Kuhn claims are incommensurable) have in fact been compared.
>
> Therefore, the theories are not incommensurable.

Now this argument only works when we add as a missing premise that incommensurability implies non-comparability, which is to say, by contraposition, that comparability entails commensurability. Kuhn's response, again, is that comparability does not entail commensurability in its mathematical usage. The implication, clearly, is that comparability should not be expected to entail commensurability in his usage either:

> No more in its metaphorical than its literal form does incommensurability imply

[41]Leeds, "Incommensurability and Vagueness", *Noûs*, 31:3 (1997), p. 385.

incomparability, and for much the same reason.[42]

But there is a potential problem here. Kuhn is not using 'incommensurable' to mean 'not in rational proportion' but, rather, 'lacking a common language'. This appears to be a usage which is intended to parallel the mathematical usage. Kuhn himself calls it 'metaphorical'. But in a metaphorical usage we cannot assume that all of the attributes that apply in the original usage will necessarily apply in the new usage. Fans may say that 'Clapton is a god', but before crediting him with omnipotence and other divine characteristics, we should really consider a touch more closely whether this non-literal usage (since, presumably, it is a non-literal usage) can support predication of such characteristics to the new subject. Similarly we need to examine whether, in Kuhn's usage, comparability as a characteristic should apply in his non-metaphorical usage of 'incommensurability'.

Kuhn's interest in the mathematical usage of incommensurability seems to be with the notion of expressibility. We have seen that the irrationals cannot be expressed in terms of the rationals (although we have also seen that the reverse is not always the case, which fact is not explicitly recognized by Kuhn and on which point Kuhn's usage does not follow the mathematical usage). Kuhn wishes to maintain that two theories that are incommensurable contain key terms which are not *ever* expressible in the incommensurable paradigm. But the mathematical usage does allow some rationals to be expressible in terms of irrationals.

When we say, however, that two numbers which are incommensurable are yet comparable, we said that we meant by 'comparable' that the numbers are comparable with

[42]"Commensurability, Comparability, Communicability", p. 670. By 'literal' Kuhn appears to mean what we have referred to as the 'mathematical' usage.

respect to the standard ordering of the reals, which means that there is a correct answer to the question as to whether, for any two incommensurable numbers x and y, it is the case that $x > y$ or, rather, $y > x$. But what, then, is the analogue to this in Kuhn's usage of the word? He seems to want to assert that, in his use of the term, incommensurable theories may yet be comparable in various ways, perhaps in their respective usefulness in explaining, or predicting, various observable phenomena. He should certainly have made more clear what characteristic is was of which he was ascribing comparability, but we shall suppose that he intended something like those just mentioned. Since these are the sorts of comparisons which will enable us to highlight the differences between incommensurable theories, they seem to be emblematic of the sorts of comparisons that Kuhn should wish to make.

In the mathematical usage we have seen that infinite precision is required, and is available to us. This is not to say that we have a name, or can even give a name, to each irrational number. We have names for certain of the irrationals, e.g., '$\sqrt{2}$', but for the vast majority of them we have no name and cannot hope to ever state a name, since an irrational is, by definition, an infinite non-repeating decimal. This access to infinite precision, as we have seen, in some way enables mathematical incommensurability since, without it, incommensurability disappears. If Kuhn wishes to construct his metaphor on the mathematical usage, therefore, it would seem that he should claim that the point of the notion of incommensurability is that while infinitely precise language enables the notion, this does not preclude our ability to compare (in some way, for some purpose, which also must be described). But since many scientific theories are commonly stated in a natural language, infinite precision is clearly too strong a requirement. We see, however, that Kuhn does not speak even of a very precise language but of a common language. But if he wishes to speak of incommensurable theories as lacking a common language, and to claim that the lack of a common language does not preclude our ability to compare, then we need to be clear about what Kuhn means by "common language". If we return to Kuhn's text, however, we find two notable discussions, one of which refers to translations "without residue or loss", another referring to translations which "tell more or less the same story". The first of these may fulfill our requirements for precision, while the second appears to readily allow for comparability between incommensurable paradigms. But can we reconcile the two discussions? Without significant precision Kuhn cannot hope to demonstrate that translatability is impaired. Without comparability, he cannot hope to make his grounds for rational choice. Can he have it both ways?

Before we make this attempt, however, we may note that it does seem that the sorts of comparisons we wish to make will require at least some common language, particularly in regard to the areas of the opposing theories in which the key differences are highlighted. Yet it seems that these are just the areas in which Kuhn needs to argue for the lack of a common language, since the areas in which no major differences are highlighted are, presumably, those in which no major meaning shift has occurred. The reason that common language is required for comparability is that the only way to compare two theories is, really, to compare *and contrast* the two, and this requires the ability to explicate these differences in order to design the test that will highlight the differences. This discussion also demonstrates why the appeal to an observational vocabulary to support comparability will not suffice: common observational vocabulary presumes commonality of theoretical vocabulary in order to design the tests.

This last comment may seem unlikely to some. It may be determined, for example, that in T_1, under conditions C, observable phenomenon P_1 will be observed, while, in T_2 (a theory which is, by hypothesis, incommensurable with T_1), under conditions C, observable phenomenon P_2 will be observed. All we then need to do is to conduct an experiment under conditions C to see whether P_1 or P_2 occurs. This seems to offer common observational vocabulary without common theoretical vocabulary, since one may, perhaps, readily conduct the experiment knowing the theoretical vocabulary of one, both, or neither of the two theories. And in a sense it does offer both common observational vocabulary and comparability without common theoretical vocabulary. But there are two reasons that prohibit Kuhn from using this example. First, Kuhn does not really care about what experiments lay people may be taught to execute. His concern is with scientists devising tests to highlight the differences among theories, and this cannot be done without an understanding of the two theories sufficient to suggest to the scientist what these differences are, and this requires some commonality of theoretical vocabulary. The fact that our example allows for one experimenter to know the theoretical vocabulary of neither of the two theories suggests that the experimenter, in this case, may be entirely removed from the scientific community. The second reason that Kuhn cannot use this example is that there can be, for Kuhn, no such thing as a common observational vocabulary: since our observations are theory-laden, we cannot hope to agree on a common observational vocabulary with a proponent of an incommensurable theory.

For at least theoretical discussions, it would appear that language is a pre-condition on our ability to compare, since we require language both to describe the theories and to describe the means of comparison. But then the lack of a common language appears to be fatal to comparability. That the language must be a common language is clear from the following example. Suppose we have a scientist trained in the Ptolemaic cosmology and another trained in the Copernican cosmology. They cannot effect a comparison until the system of one is understood by the other (and, hopefully, vice versa, else the comparison may only be effected by one of the two).[43] Then, not only is language a pre-condition, but the language must be common. But if comparing requires a common language, and Kuhn's notion of incommensurability means 'lacking a common language', then Kuhn's notion of incommensurability cannot retain comparability as a characteristic. The fact that the mathematical usage is able to do so (if it really is able to do so) is not to the point. We need, again, a better understanding of Kuhn's notion of a common language.

We have seen that Kuhn describes 'common language' as both "telling more or less the same story" and as translating "without loss or residue". It seems clear that the first of these is the less stringent condition, and it seems equally clear that we can, today, "tell more or less the same story" in a common language in explaining both the Ptolemaic and Copernican cosmologies. Similarly, it seems more than likely that an historian of science could write an essay that would explain to the modern reader the concept of 'phlogiston', which, again, will demonstrate the ability to "tell more or less the same story". What, however, of Kuhn's more stringent condition, that we be able to translate without loss or residue?

The first objection to the more stringent condition is that it assumes that we can determine whether we have in fact made such a translation, while the thesis of the radical indeterminacy of translation maintains that we cannot do so. Now Kuhn has made abundantly

---

[43]For Kuhn, of course, it is the historian of science who really must effect the comparison, but the point remains.

clear that his is not a Quinean view. He still needs, however, to explain what would be the test of success of a translation that *does* translate without loss or residue. In other words, how are we to decide whether we have made a successful translation or not? One test is given:

> But the referring expressions of one language must be matchable to coreferential expressions in the other, and the lexical structures employed by speakers of the language must be the same, not only within each language but also from one language to the other. Taxonomy must, in short, be preserved to provide both shared categories and shared relationships between them. Where it is not, translation is impossible, an outcome precisely illustrated by Kitcher's valiant attempt to fit the phlogiston theory to the taxonomy of modern chemistry.[44]

We see here that, for Kuhn, the granularity of meaning forbids the use of 'phlogiston' in modern chemistry, just as Kuhn has argued that the French 'moux/molle' cannot be translated into English without loss or residue. But what, then, of the Ptolemaic/Copernican controversy? No restructuring of how we categorize objects seems to have occurred here. The earth, which was not considered a planet before, is now considered to be so. But the categories themselves have not changed, save that one category, 'that around which the universe revolves', perhaps, has been eliminated. Kuhn's best defence now would seem to appeal to a behavioural test of a successful translation, such as Quine's notion of stimulus synonymy, but this will not really help in the long term since, again, many paradigms which are incommensurable in Kuhn's terms seem, sometimes with the passage of time, to be non-problematic for scientists. Examples here include the move from the Ptolemaic to the Copernican cosmology, the move from Euclidean to non-Euclidean geometries, and the move from classical to relativistic physics.

Kuhn suggests that comparability is possible in discussions between competing

[44]Kuhn, "Commensurability, comparability, communicability", p. 683.

paradigms because, while a few specialized terms have suffered from shifts of meaning, the vast majority of terms have suffered no noticeable meaning shift at all. The implication is that the vocabulary held in common allows for comparability. But the following three considerations suggest that this avenue does not provide much of an escape for Kuhn. First, if one uses a word that is unknown to another, then the fact that the second person knows every other word in the sentence does not necessarily help at all. If someone says 'Where is my fex?', the fact that we are entirely familiar with a phrase like 'Where is my x' does not help us at all if we do not recognize the word 'fex'. We may, of course, explain that we do not recognize the word and ask for a definition, but the point is that knowing the majority of terms does not, in and of itself, necessarily enable us to gain even a general understanding of what the unknown terms mean. The common language in this case clearly does not allow for even vague understanding, much less comparability. This problem increases in direct proportion to the degree of 'specializedness' of the terms involved, which suggests that this problem will be most acute in discussions such as those Kuhn is talking about.

In the case of the exposition of a scientific theory, of course, one does not ordinarily expect to have to ask for the definition of unknown terms since the expositor, who is introducing such a term, will offer definitions, hopefully in words that are known to the audience. In this way, for example, one hoping to re-introduce the notion of 'phlogiston' would, presumably, spend a great deal of time and effort explaining what the word represents in order to try to gain the understanding of the audience.

The second consideration that suggests that Kuhn's view, that meaning shift is restricted to a few key terms, will not fix his problem pertaining to the comparison of various aspects of competing scientific theories is that this case is vastly more complex than is the case for the introduction for neologisms for the reason that the terms are not unknown to us and that we are therefore tempted to assume that the terms mean exactly what they have always meant. The initial problem, then, is not in understanding the subtle difference of meaning of a term in a new paradigm but in knowing that meaning shift has occurred at all. Take now a case where someone in an office environment says to us 'Where is my fax?', and suppose that they have come to use the word 'fax' in a slightly different sense, meaning 'output of a facsimile machine on white paper'. The first issue here is that of recognition of meaning shift. Since fax machines, in the vast majority of cases, provide output on white paper, we may never recognize the shift at all since the difference that highlights the shift may never be encountered. Now if there is a recognition of the meaning shift, this shift can be quite readily described by one who understands the new usage using vocabulary that is common. But then both parties understand, both parties effectively communicate, and there is evidence of a common language. If there is a recognition of the meaning shift, but the shift cannot be readily described by one who understands the new usage using vocabulary that is common, then there is no common language, and there can be no comparability either. (There may, of course, be comparability from the perspective of one who can describe the meaning shift, but this person also has common language.) From the perspective of the one who understands the new usage there is comparability but there is also a common language (keeping in mind that the 'commonality' being discussed here is not 'commonality between individuals' but, rather, 'commonality between usages'). Again we find no case in which there is both comparability and no common language.

Even a community of individuals who speak a common natural language may discover disagreement on the meaning of a term that is thought to be widely understood. Suppose in the above example that one day the fax machine is loaded with neon yellow paper. Suddenly disagreement must arise as to whether a given sheet of output is a fax or not. Nor is this a particularly fanciful example, since such disagreements seem quite common. Is marriage between homosexuals possible or does marriage mean only 'marriage between two persons of the opposite sex'? Is doctor-assisted suicide murder? Is abortion murder? All of these cases suggest a breakdown of borderline cases which demonstrates the lack, or fuzziness, of definitions in our use of everyday language. And this fuzziness is by no means limited to the ignorant, the uneducated, or to obscure subject matters, as the examples given demonstrate. And if such everyday concrete terms exhibit significant degrees of vagueness, then why not such abstract scientific terms as 'mass'?

To better understand the third consideration, consider the case of Kepler's discussions with the Ptolemaics. One who believes that the sun orbits the earth understands the meanings associated with the words contained in the sentence 'The sun orbits the earth'. Similarly, one who believes that the earth orbits the sun understands the meanings of the words contained in the sentence 'The earth orbits the sun'. Now the words in both cases are the same words. But are the meanings of the words the same? The fact that they appear in different paradigms does not necessarily imply that a meaning shift has occurred, since even Kuhn does not argue that the meanings of all terms have changed. In fact he relies on some stability of meaning to allow for some degree of communicability. And yet, if these word have not suffered meaning shift, then which words have done so? One can clearly argue both sides of this issue as to whether the meanings of 'sun', 'moon', and 'orbits' have shifted in this case, as the meaning of 'meaning' has generated much debate. In this case the issue is twofold: first, is the relationship of the earth to other celestial bodies necessarily part of the meaning of 'earth'?; secondly, is the classification as a kind or category necessarily part of the meaning of a word (i.e., in this case, is 'planet' part of the meaning of 'earth')? Now whatever answers we may propose to these two questions it is clear from the historical discussion in the Appendix that the rival astronomical schools did not appear to have any trouble understanding their rivals' views. It is pertinent that, all these centuries later, we also do not have any difficulty apparently understanding both views even though we have, most of us, done no detailed research in the field and have spent virtually no time whatsoever immersing ourselves in the discussions of the period so as to enable us to 'go native' and so come to understand the subtle, or revolutionary, meaning shifts that may have taken place over the intervening time span. This does seem to provide evidence that at least in this case there did exist common language. But this case is one of Kuhn's exemplars of paradigm shift, and even here we do not find an example that demonstrates both comparability and no common language.[45]

These three points call into question Kuhn's argument that the unchanged terms between incommensurable paradigms are sufficient to allow for comparability. There is not sufficient reason to suppose that the vocabulary held in common across incommensurable paradigms allows for comparability.

---

[45]See Kuhn, *The Structure of Scientific Revolutions*, 2nd ed.,p.66.

3.3 The challenge of mathematics

It is ironic that the field of study least amenable to Kuhn's notion of incommensurability is mathematics, the field from which Kuhn borrowed the term. While Scheffler has noted that mathematics is "...oddly enough, largely ignored in Kuhn's treatment",[46] it strikes me that this fact is largely explainable. There are serious challenges to Kuhn here, which together provide significant reason to believe that Kuhn's notion of incommensurability is not viable.

Euclidean geometry, as we know it today, may be seen as the class of theorems derivable from the five postulates and the definitions provided. The fifth of these postulates claims that, given any line, and a point not on that line, there is precisely one line that passes through that point and which is parallel to the given line. From this rather slim group of postulates is derived an astounding volume of mathematical theorems, which make up this particular geometry. Later mathematicians, notably Riemann and Lobachevsky, rejected the fifth postulate and investigated non-Euclidean geometries by replacing the fifth postulate with various alternatives.

Now, in a geometry built on postulates, like a logical calculus built on axioms, we are claiming, at some level, 'If you accept these postulates (axioms) and the rules of proof, then you must accept $T_1, T_2, \ldots$' where $\{T_1, T_2, \ldots\}$ represent theorems that are demonstrated using the rules and the postulates (axioms) stated. Since these theorems are provable, they must be accepted, when demonstrated, if one accepts the postulates and the rules of proof. Note that they may be accepted without being proven, as may happen if the proof is very complex or the 'accepter' is rather simple, but in this case the theorem was never really proven at all. We also

[46]Scheffler, *Science and Subjectivity*, p. 79.

accept that one may claim not to accept the postulates in the first place, but we have explicitly accounted for this by saying 'If you accept these postulates...', essentially acknowledging the conditional nature of the commitment. But, given that the theorems of a system of geometry are provable, then the theorems, and so the geometry itself, can never be disproved unless the underlying logic (i.e., the rules) that provides the infrastructure necessary to the proof is shown to be faulty. We need not say here that the theorems are valid only within the paradigm in which the given postulates and rules are accepted, since they carry this burden with them in the way of explicitly delineating, as antecedent, what postulates and rules they assume. But because of this antecedent, they are therefore valid in any paradigm into which they can be translated, even in paradigms in which the postulates and rules are not generally accepted. But if they are valid in every paradigm into which they can be translated, they can never be replaced but only subsumed. Since they are subsumed, they remain valid in any other paradigm in which they have been subsumed. In the case of Euclidean geometry, we say that it remains valid in Riemannian or Lobachevskian geometry as a special case. But if the geometry remains valid (even if only as a special case) in the subsuming paradigm, then the vocabulary required to express it must be available in that paradigm. But then it is not true that there is no common language between the two paradigms since the entire vocabulary of the one is contained in the other.

There is a sense in which we are, so far, begging the question. We have made reference to theorems being valid in every paradigm into which they can be translated. Kuhn, of course, would maintain that we cannot translate the Euclidean case into a non-Euclidean paradigm, since the meanings of key terms have suffered meaning shifts, whether subtle or not so. 'Triangle', for example, which is, in the Euclidean paradigm, an enclosed polygon containing three straight lines, is still defined the same way, but "straight line" no longer means what it did in the Euclidean paradigm. We do, then, need to support the notion that we can, in fact, translate without residue or loss, from the Euclidean to the non-Euclidean paradigm.[47] Clearly the translation is not simply homophonic but in this case must eliminate what is, in general, the differentiating factor between the two paradigms, viz. that we are restricting ourselves to only cases with zero curvature. It becomes evident from this brief description that this is a case in which the earlier geometry was, in some way, incomplete, and that, in the more sophisticated geometry, we must now make explicit certain presuppositions that were only implicit before.

What we see in this example is preservation of content in the move from one paradigm to another, rather than preservation of formulas. That triangles have internal angles totalling 180° is a proposition that is refutable in the non-Euclidean paradigm, so clearly the formula has not been preserved in the subsumption of the Euclidean paradigm. What has been preserved is the content of the Euclidean formula, i.e. that at zero curvature the internal angles of a triangle total 180°.

There has, in fact, been some considerable discussion in the literature as to whether revolutions may occur at all in mathematics. A recent book edited by Donald Gillies contains a selection of essays under the title of *Revolutions in Mathematics*. Like Stephen Leeds, Gillies

[47]Note that we do not need to argue for two-way translation, since the non-Euclidean paradigm is, admittedly, clearly not subsumed in the Euclidean paradigm. Similarly, we saw that mathematics before the discovery of incommensurability can expressed in the post-incommensurability paradigm, but not vice versa.

takes it for granted that Kuhn's program is widely accepted:

> ...it is, I think, fair to say that Kuhn's overall picture of the growth of science as consisting of non-revolutionary periods interrupted by the occasional revolution has become generally accepted. [48]

He does not, however, accept all of Kuhn's theory, particularly that part pertaining to his assertion that paradigms are incommensurable:

> To begin with I reject the idea that paradigms are incommensurable, since it seems to me quite easy to compare them...[49]

We have already seen this identification of incommensurability with incomparability in other authors, and the next chapter will offer a closer examination of the two concepts.

The starting point in Gillies' collection of essays is Michael Crowe's "Ten 'laws' concerning patterns of change in the history of mathematics". Law number ten states, bluntly, that "Revolutions never occur in mathematics".[50] Crowe argues that a revolution, by definition, must destroy what came before it, and that this does not happen in mathematics; we see, rather, a cumulative increase in knowledge:

> For this law depends upon at least the minimal stipulation that a necessary characteristic of a revolution is that some previously existing entity (be it a king, constitution, or theory) must be overthrown and irrevocably discarded.[51]

Herbert Mehrtens, while sympathetic to Kuhn's views, ultimately rejects their applicability to mathematics:

---

[48]Gillies, *Revolutions in Mathematics*, p. 1.

[49]Ibid., p. 9.

[50]Crowe, in Gillies' *Revolutions in Mathematics*, p. 19.

[51]Ibid.

> The general pattern of T. Kuhn's theory of the structure of scientific revolutions seems to be not applicable to mathematics.[52]

Joseph Dauben, however, takes exception to Crowe's requirement that the old theory must be discarded in order for the new theory to be considered revolutionary. His first example of what he considers to be a revolution in mathematics is, ironically, the discovery of incommensurability by the Pythagorean school. Even Dauben, however, accepts the cumulative nature of progress in mathematics and, tellingly, refers to this process as 'evolution':

> Because mathematics is restricted only by the limits imposed by consistency, the inherent structure of logic determines the structure of mathematical evolution. I have already suggested the way in which that evolution is necessarily cumulative.[53]

In speaking of incommensurability and other examples of significant change in mathematics (irrational, imaginary, and transfinite numbers; calculus; non-Euclidean geometries) Dauben says:

> None of these involved crisis or the rejection of earlier mathematics, although each represented a response to the failures and limitations of prevailing theory.[54]

Now this approach may be suitable for Dauben, who wishes to maintain a view of mathematics that he seems to call both revolutionary and evolutionary. Crowe, by contrast, maintains that mathematics itself is evolutionary but that the surrounding context of mathematics may undergo revolutionary change (he mentions as candidates such things as nomenclature, symbolism, metamathematics, methodology, and the historiography of mathematics).[55]

---

[52]Mehrtens, in Gillies' *Revolutions in Mathematics*, p. 35.

[53]Dauben, in Gillies' *Revolutions in Mathematics*, p. 63.

[54]Ibid.

[55]Crowe, op. cit., p. 19.

Ultimately, however, we must determine whether Kuhn can accommodate a view like Dauben's, or whether he must agree with Crowe that revolutions do not occur in mathematics. Alternatively, he may have some other line of argument which he can rely on to explain how his paradigm of paradigms may help in the understanding of the history of mathematics, and how the two views may be reconciled.

Now, first of all, it seems clear that Kuhn cannot accept a view like Dauben's. For Kuhn the major point, and the major indicator, of a revolution in the history of science is the set of problems of communicability between proponents of the competing paradigms, which set of problems ultimately leads him to talk of incommensurability. But if mathematics is cumulative, then the previously existing theory is not necessarily plagued with problems of meaning shift and incommensurability does not arise. While meaning shift does occur, as we saw with "straight line" in the move from Euclidean to non-Euclidean geometries, incommensurability does not arise because translatability is maintained. This scenario does not, therefore, constitute a revolution in Kuhn's theory. From the following passage it is clear that cumulative change is, in Kuhn's view, not revolutionary. Here Kuhn is talking about the kind of change in science that precipitates paradigm change:

> It is just because this type of change, little recognized or discussed in the literature of the philosophy of science, occurs so regularly on this smaller scale that revolutionary, as against cumulative, change so badly needs to be understood. [56]

In any case, Dauben's view seems to lead to a theory of revolution that is so watered down as to be wholly innocuous. For Dauben 'revolutionary' seems to mean 'significant and new'. In discussing the development of the calculus, for example, he says:

---

[56]Kuhn, *The Structure of Scientific Revolutions*, p. 181.

> Though revolutionary, the calculus was not an incompatible advance requiring subsequent generations to reject Euclid; nor did Cantor's transfinite mathematics require displacement and rejection of previously established work in analysis, or in any other part of mathematics.[57]

Compare the following passage from Kuhn:

> The normal-scientific tradition that emerges from a scientific revolution is not only incompatible but often actually incommensurable with that which has gone before.[58]

So for Kuhn incompatibility is required, while for Dauben compatibility is expected. Dauben's view will clearly not suffice for Kuhn.

Is there, then, any alternate line of argument for Kuhn? Should he wish to argue for revolutions in mathematics he must also argue for incommensurability, which is an indicator of revolutionary advance. So, is incommensurability, in the mathematical sense, incommensurable, in Kuhn's sense, with the mathematical systems known prior to the discovery of incommensurables? In a sense one may argue that it is: 'incommensurability' is not a term that existed prior to the discovery of incommensurables so, in that sense, proponents of the two theories will talk at cross-purposes since one group will be using a word that is foreign to the other group. But this is not incommensurability in the sense in which Kuhn has been using the term, since he has been talking in terms of meaning shift rather than talking in terms of net new vocabulary. In other words, since the subsuming theory can express everything that can be expressed in the subsumed theory, so the language of the subsuming theory suffices as the common language between the two theories. Are there other terms that have suffered meaning shift? One may argue that 'commensurability', applied to the integers, will also not be

---

[57]Dauben, op. cit., p. 62.

[58]Kuhn, *The Structure of Scientific Revolutions*, p. 103.

understood by the proponents of the old paradigm, but this is the same case as that of 'incommensurability' discussed above. So it seems that if meaning shift has occurred, it can be readily accommodated through a simple translation, so there is no evidence of incommensurability between the two paradigms, and it appears that revolutions in mathematics, in the sense argued for by Kuhn, did not occur in the cases we have examined.

3.4 If not incommensurability, then what?

If Kuhn's notion of incommensurability as 'lacking a common language' fails to provide us with a viable description of what happens to scientific terms during a meaning shift, then what factor is at work? Evidently such meaning shifts do occur. Kuhn's example of 'phlogiston' provides us with a concept which is not readily expressible in current language (although Kuhn's brief description of the concept does seem to express it quite concisely and successfully). Terms in mathematics have similarly undergone major meaning shifts, an obvious example being 'infinity', at one time singular, now pluralized.

Ramberg's theory of meaning shift, somewhat confusingly referred to by Ramberg as 'incommensurability', seems to provide us with a suitable answer to this. In Ramberg's theory[59] a communication breakdown occurs when the meanings of words change so rapidly that confusion results to the participants of the discussion. This breakdown continues until the participants are able to recognize the confusion and then come to some agreement on the meanings of the terms involved, i.e., until they are able to agree on the appropriate linguistic

---

[59]Ramberg, *Donald Davidson's Philosophy of Language*. For a recapitulation see discussion in the Appendix.

conventions. While Ramberg claims that this phenomenon is not a form of 'intranslatability'[60] it is difficult to see why he believes this. If the process he describes is a temporary breakdown in communication it would seem that during the transition there is some level of 'untranslatedness'. Given that the breakdown is temporary, one would suppose that, after the transition, there is no longer some level of 'untranslatedness'. It seems, in fact, as if 'temporary intranslatability' is exactly what he is describing, and that this would be a far more effective term for him to use than 'incommensurability'.

Feyerabend seems to come close to this view as well:

> I should add that incommensurability is a difficulty for philosophers, not for scientists. Philosophers insist on stability of meaning throughout an argument while scientists, being aware that 'speaking a language or explaining a situation means both *following* the rules and *changing* them'...are expert in the act of arguing across lines some philosophers regard as insuperable boundaries of discourse.[61]

While it is likely an overstatement to suggest that scientists do not insist on stability of meaning it does appear that Feyerabend here recognizes that meaning shift is a phenomenon that may occur in scientific discourse and so would presumably agree that such a shift may cause difficulties in analysing and understanding new theories. Quine makes much the same point:

> There are, however, philosophers who overdo this line of thought, treating ordinary language as sacrosanct. They exalt ordinary language to the exclusion of one of its own traits: its disposition to keep on evolving. Scientific neologism is itself just linguistic evolution gone self-conscious, as science is self-conscious common sense.[62]

Now by the use of the word 'neologism' Quine suggests here that he is thinking of new terms

---

[60]Ramberg, p. 129.

[61]Feyerabend, *Putnam on Incommensurability*, p. 81.

[62]Quine, *Word & Object*, p. 3,

rather than meaning shifts in accepted terms but the point remains that language, as an evolving entity, must accommodate the changing requirements of the people who use it. That being the case, it should not be entirely surprising to discover that the further back we reach in the history of a language for a term, the less likely are we to understand that term in the way that it was understood at the time of currency. So we find, for example, that Orwell is more easily understood than Shakespeare, Shakespeare more easily understood than Chaucer, and Chaucer more easily understood than the Old English sagas.

This brings us back to the issue of translatability. Is 'phlogiston' translatable into current English or not? Kuhn accepts that we may immerse ourselves in the writings of the time and so 'go native' and understand the meaning of the term at the time it was then used. But does this provide translatability? Consider the words of Richmond Lattimore writing about Odysseus in the Introduction to his translation of *The Iliad* of Homer:

> Essentially, he can be described by the Greek word *sophron* (though the word is not Homeric). This is untranslatable. It means, not necessarily that you have superior brains, but that you make maximum use of whatever brains you have got.[63]

Now it appears from this passage that Lattimore supposes that 'untranslatable' means that there is no single word in English that conveys the same meaning as the original Greek word. He is, however, able to quickly and easily convey the meaning of the Greek word in the next sentence. We might say that he effectively finds a way to 'tell more or less the same story'. If Kuhn means by 'incommensurability' the same as Lattimore means by 'untranslatability', then it is difficult to see why he makes such a fuss over the issue since we know how to resolve it.

---

[63]Lattimore, *The Iliad* of Homer. Phoenix Books, The University of Chicago Press; (1961), p. 50.

But if Kuhn means that it is not possible to convey the same meaning even in an extended description, then it is difficult to see how he can argue for comparability and, ultimately, even for coherence and the possibility of theory choice at all, since, as we have seen, the lack of a common language calls into question all these things. It is, therefore, difficult to see how Kuhn's view amounts to more than the view that significant meaning shifts may occur rapidly as scientific theories evolve and that the scientists who are trained in the traditional view may experience difficulty as they try to accommodate the new meanings of the relevant terms. Granted, this may be complicated by the fact that meaning shifts may occur in multiple key terms, so the resolution may be made more difficult because the interconnectedness of the terms in question makes the comprehension of the entire paradigm impossible until multiple meaning shifts are recognised simultaneously.

4.0 Commensurability and comparability

We have seen throughout our discussions that there is considerable confusion in the literature as to the relationship between commensurability and comparability. Joseph Raz seems to take the terms to be identical ('interchangeable' is the term he uses). It appears that Bernard Williams, as well as numerous others, do the same, although not always explicitly. That these two notions cannot always be taken to be identical, or even equivalent, seemed at first to be clear from our discussions of the mathematical notion of commensurability, where we said that commensurability must be different from comparability, since any two real numbers which are incommensurable are still comparable with respect to the standard ordering of the reals. Even that discussion, unfortunately, is less than clear in its applicability to the current case, since the mathematical notion of incommensurability is quite different from the usages some of the philosophers we have examined had in mind. In particular, Finnis's usage was based on the etymological usage, while Kuhn's usage was a metaphor based on the mathematical usage, which is, in turn, arguably a metaphorical usage.

Clearly not everyone is in agreement with Raz and Williams on this identification of commensurability with comparability. Chang, for instance, writes that:

To think that comparability requires a single quantitative unit of value according to which items can be measured is to mistake commensurability with comparability.[1] If one should wish to argue that, at least in the etymological usage, commensurability and comparability are synonymous (as, indeed, Raz appears to do), the obvious objection to this is that, if there are two equivalent terms, one well known and widely understood, the other obscure and little used, then we ought in most cases to use the more widely understood of the two terms.[2]

4.1 Commensurability and comparability - the relationship

So what is the relationship between commensurability and comparability? First, it seems clear, from both the mathematical usage and the other usages, that the two notions are related since metricisation is, at least often, used for purposes of comparison. That is, we often measure two things in order to be able to say that A is greater than B (in some relevant sense of 'greater than'), or that B is greater than A, or that A and B are equal (to some agreed-to degree of precision).

The mathematical usage, again, has seemed to tell us that comparability does not entail commensurability. It would be easy to quickly jump to the conclusion that comparability does not, in principle, guarantee that the two numbers have a common measure. We have seen, however, that this does not follow, since incommensurability has been shown, in mathematics, not to mean 'lacking a common measure' at all but, rather, 'not in rational proportion', which

---

[1]Ruth Chang, *Incommensurability, Incomparability, and Practical Reason*, p. 19.

[2]We acknowledge that there may be cases, such as in poetry, where this general rule of 'eschew obfuscation' does not apply.

is the basis for the suggestion, above, that the mathematical usage may be seen as a metaphorical usage. Before pursuing this issue perhaps we should turn first to the easier aspect of the relation between commensurability and comparability.

Does commensurability entail comparability? That is, if we can avail ourselves of a common measure is it necessarily the case that we can describe some grounds for comparison relative to that measure? Our immediate inclination is to respond in the affirmative, since the existence of a measure in and of itself appears to require the common property which may then provide the grounds for comparison. But let us examine the case in a bit more detail. If we consider two cars, we are inclined to say that they are both commensurable and comparable with respect to certain characteristics. In fact those characteristics which we might measure would be the same characteristics which we would compare: acceleration, braking, fuel consumption, etc.

Consider now the case of a car and a horse. If we ask the question 'Is this horse comparable to this car?' the answer would likely be 'In what respect?'. Clearly we can imagine respects in which the two are comparable, e.g., colour, comfort, acceleration, horsepower, etc.[3] If we ask the question 'Is this horse commensurable with this car?', however, we are initially at rather a loss, since by 'commensurability' we seem to mean 'commensurability with respect to a quality or characteristic which is understood based on the context provided by the things under discussion', and no such quality is uniquely identified in the asking of this question. This occurs primarily because the context does not tell us what is the quality under

[3]I am told that *Road & Track* in the late 1960's did a road test of a horse (in an April issue, of course) providing data similar to that usually provided for automobiles.

consideration. For example, when a mathematician maintains that the square root of two is incommensurable with the integer three, he does not normally need to specify the property under consideration since the context of the discussion makes this clear. It also makes clear which of the various sense of 'incommensurability' he has in mind.

If we take 'incommensurability' to mean 'lacking a common measure', then the 'common' would be expected to refer to at least two distinct things. But a relation between what sorts of things? Well, a relationship between things that share whatever aspect of the thing it is that the measure measures. For example, if we are considering a car and a horse with a view to co-measuring, we need to decide what type of thing we are treating each of them as being, since the context in this case has not does this job for us. In other words, some may say, the only things to which commensurability applies are instances of a single type, meaning here by 'type' simply 'class of things that share a particular aspect that the given measure measures'. But in this case commensurability does entail comparability since, if a prerequisite of commensurability is commonality of types, we should always be able to find the means of comparison among instances of a single type. Since measuring requires that we be able to assign a real number, the ordering on the reals, being a total ordering, guarantees comparability.

This discussion should be clarified as to what it means to be a type, given the simple characterization of 'type' given above. While it works well in discussing commensurability and comparability of instances of a single type it is, at first, confusing where the things under discussion are not in any obvious way instances of a single type. Cars and horses, for example, are not generally thought of as instances of a single type although, since they do, for example, share the property of bearing colour, they may be compared with respect to that property. We may say then that they *are* instances of a single type, the type in question being 'colour-bearing objects', although, surely, what we are discussing is the colour of the objects, and we turn to a discussion of properties of objects. A horse may be an equine quadruped to a biologist and a coloured object to an examiner of colour, but this crosscutting of categories seems to be about properties of things. Using 'type' in the way defined above, therefore, (and in the way I shall continue to use it), I am really talking about commonality of properties of things.

4.2 That commensurability entails comparability

While I do believe that commensurability entails comparability, we might make some further comments on the nature of the relationship. Comparability refers to comparability with respect to properties that objects possess, the object being any potential object for possessing the property in question. In other words, 'comparability' means 'comparability of subjects with respect to a particular property', which is why we must specify the property unless it is made clear by the context. Therefore, if a math teacher asks us to compare the numeral 7 written in yellow chalk on the blackboard with the numeral 5 written in white chalk on the blackboard, we might expect that the desired comparison has to do with the two symbols rather than whether the characters are written in different colours, or at different times, or by different hands (although this expectation may, of course, be unfulfilled). However, throughout the act of comparing, we are comparing properties of objects.

Commensurability is different, since we can comfortably discuss the commensurability of properties without apparent reference to any specific object. Specifically, the issue is whether we can, using a single unit of measure, measure the property in question. In the case of ordering the real numbers a two-place property we may seek to measure is 'greater than with respect to the usual ordering of the reals'. And, since mathematics represents a well-defined context, we do not generally find ourselves confused about what property this is.[4] (There remains, of course, a question of ontology as to whether a number is a thing other than a designator for the size of the number, but whether a number has a real existence beyond this designation is not an issue that need concern us here, since all we need for determination of both commensurability and comparability is the property itself. That is, we can comfortably treat numbers as subjects of predication.)

This helps to explain why some may have found the question of the ascription of commensurability between the horse and the car to be somewhat problematic: we are asking a question about objects that should properly be asked only about objects with respect to a specific property, since commensurability applies only to such objects. Whenever we attempt to compare two objects that are not normally thought of as being similar sorts of objects, we immediately become aware that, given that a comparison is a comparison of objects with respect to a specific property, we need to establish what is the property in question. Thus we tend to immediately ask 'In what respect?'. Which is to say that we need to determine what is the property common to both objects. When we attempt to establish commensurability we

---

[4]Issues of comparability may arise in mathematics where the context is confused, or no longer clear due to vagueness. For example if we are asked 'Which is bigger, 10001_2 or 101_{10}?', we now may need to specify whether 'bigger' means 'bigger qua number of digits' or 'bigger qua value'. Commensurability, in the Kuhnian sense, does not seem to be compromised here since we can readily express either number in the base of the other, so that there are no issues of translatability.

may not immediately recognise the problem in the case where the property in question is not at all apparent, and we may ultimately determine that the question itself is faulty in some way while, in fact, what is required is simply a clear statement of what is the property in question. Consider, for example, legibility and clarity. Are they comparable? It is not clear that we can answer this question appropriately. We can, perhaps, imagine contexts in which they are comparable. However, if it is the case that we can compare only objects with respect to a specific property, then it would seem that, if no property is specified (implicitly or explicitly), objects are not comparable. Are they commensurable? Neither can we answer this question: since commensurability means commensurability with respect to a specific property, where there is no property there can be no commensurability either. But even this is rather too facile, since it would seem that any context that would allow us to compare the two also gives us a context in which we could devise some way to co-measure the two. In other words, every context that allows for comparability also provides an avenue for commensurability. The real issue seems not to be whether we *can* co-measure, since there seems to be no reason, in principle, why we cannot do so. What is not always clear, however, is how to do so in a way that is either interesting or important.

Let us consider scientific theories. How would you compare relativistic physics with classical physics? We may immediately begin to think of ways to effect a comparison by choosing properties that may be exhibited by such theories, obvious avenues including the ability of the two theories to predict observable events, the ability of the two theories to explain a broad range of phenomena, the relative simplicity of the theories, etc. But would you say that the two theories are commensurable? Here, again, the question is problematic:

theories are things. Commensurability has to do with measurability with respect to properties of things, so theories, as objects, can only be commensurable with respect to a specified property. Theories are things that may have properties, and it makes perfect sense to ask of these things whether they share a property that is co-measurable. Therefore, theories, without reference to a specific property, cannot be commensurable or not. This, I think, is a large part of the difficulty in talk of commensurability: while comparability is widely understood to be 'comparability of objects with respect to a specified property', commensurability is generally understood to be 'commensurability of objects' pure and simple. It is not, and the fact that commensurability as a relation is poorly understood is yet another reason why we should refrain from using the term, at least until it is sufficiently understood. To ascribe commensurability to two objects is to say that those things share a property and that the property is one that is co-measurable. Since theories have properties, there will be aspects of theories with respect to which it makes sense to ask whether the theories are commensurable (which will normally be the same aspects of which it makes sense to ask if the two theories are comparable).

Put briefly, then, to ascribe comparability, our *ability to compare*, is to maintain that things sharing a property are comparable with respect to that property. To ascribe commensurability, our ***ability to co-measure***, is to maintain that the property in question is co-measurable. Comparability without reference to a property, implicit or explicit, is meaningless, since we can only compare things with respect to a property. Commensurability, while it seems important at the general level, is really much like comparability. If there is commensurability, there is also comparability, since any property that can be measured can be compared, as we have seen. And if we can invent a context that shows two objects to be comparable with respect to some property, then, if we can always devise a metric to measure the property in question, then wherever there is comparability, there is also commensurability. This latter question as to whether comparability entails commensurability will be examined further in the next section.

It now becomes clear that commensurability does entail comparability. This is because, where two objects are commensurable with respect to a property, this ensures that the two objects bear a common property that can be effectively measured and, where this is so, we have thereby also defined a grounds for comparison. The ascription of commensurability means not that two properties are subject to a common measure but, rather, that two objects bear a common property and that this property is one that is measurable.

4.3 Does comparability entail commensurability?

In Section 4.1 and the ensuing discussions we somewhat glossed over the question of whether comparability entails commensurability. As noted there, it is clear that 'incommensurability' in the technical sense used in mathematics does not compromise comparability, but we have also seen that the sense in which 'incommensurability' is used in mathematics is a quite different sense than the etymological usage. It, perhaps, goes without saying that the way Kuhn has used the term is quite different again, since his usage is a metaphorical usage based on the mathematical usage, which also seems to be a metaphorical usage. So, in the usages of Finnis and Kuhn, we still need to determine whether comparability, in and of itself, entails commensurability.

Let us think back to the discussion of invented measures in Section 2.4, where we discussed the kinds of measures used to rank decathletes. A quick comparison with the mathematical analogue, perhaps, is in order to determine whether the rankings offered by the scales we there considered must also provide commensurability. Can we rank in size, largest to smallest, the set containing $\{2, 1, \sqrt{2}\}$? Yes: $\langle 2, \sqrt{2}, 1 \rangle$? Does this ranking commensurate the members of the set? In a sense it does: the members of the set are ordered, and so we may say that they are commensurate with respect to that order. That is to say, we may decide that the first member takes the value one, the second member takes the value two, and the third takes the value three. Now, just as was the case with the scenarios of the distant structures, this does seem to offer a kind of measure since we have been able to assign numerical values on a scale, as can easily be seen. Therefore, we may say that this ordering allows for commensuration of the members of the set vis à vis this property. In another sense, however, we have clearly not, by ordering the set in this way, been able to commensurate the members of the set, since this ranking does not resolve the technical kind of incommensurability that mathematicians ascribe to the members of the set described, i.e., $\sqrt{2}$ is still incommensurable, in the sense demonstrated in Section 1.3, with the two integers in the set. Devising an ordinal ranking, in other words, does not commensurate mathematical incommensurability. Nor is this surprising. Nor is it surprising that this sort of ranking does not commensurate, in the etymological sense, any other properties, since 'incommensurability', in the sense we are speaking of here, means 'lacking a common measure'. There is no reason to suppose that demonstrating that some common property of two things are commensurate with respect to a specified measure should demonstrate that the two things are commensurate with respect to all measures. The heights of two people are no doubt commensurate with respect to inches, but this does not demonstrate that these heights are commensurate with respect to leap years, which measure cannot be used to measure heights in any obvious way at all.

Note, however, that in the mathematics example the incommensurability is between some members of the set while in the decathlon example there was never any question of incommensurability among the various members of the sets being measured (i.e., the long jump set, the high jump set, etc.). One athlete's long jump is clearly commensurate with another athlete's long jump. What is, at least at first, incommensurate in the decathlon is not athlete one's long jump and athlete two's long jump, but, rather, athlete one's long jump and athlete one's 100m dash. All that our second ranking for the long jump did was to produce a more meaningful sequential ranking (in the sense that it contains additional information beyond what the first sequential ranking contained) so that we could find a means to calculate a mark for each event and so to calculate who would be the winner overall. One may say that we have defined a property, say "points in the decathlon", with this purpose in mind.

This suggests that wherever we have comparability, we are able to devise a measure, so it appears that comparability does imply commensurability. Where there is comparability, there is also a partial ordering. But any partial ordering, assuming the axiom of choice, can be extended to a linear ordering, which enables for us the assignation of numbers. Eut with the assignation of numbers, we are now able to measure.

But if we are prepared to accept that such a measure as that described above allows for commensurability of disparate things such as the events in a decathlon, how does this apply to value? If the comparability required to enable us to choose among alternatives which exemplify various different values is taken to be evidence of commensurability, does this offer prima facie evidence of the commensurability of values? Not really. We must come back to take a closer look at what we are doing when we compare such alternatives. Are we really comparing, say, one situation which exemplifies play with another which exemplifies knowledge? I think not. We seem, rather, to be comparing our preference for one alternative over our preference for another, competing, and incompatible alternative. So while there is comparability, and so commensurability, of the situations at some level, the comparison is of one preference over another preference and not of one value over another value. And, while there seems to be no reason to be surprised at comparability, and commensurability, of competing preferences, such a measure is not suitable for the sorts of purposes we have in mind when doing value theory.

It begins to appear, then, as if, in the etymological sense of 'commensurability', comparability does entail commensurability, although it becomes clear that we must be extremely careful about just what it is to which we are ascribing these things.

4.4 The importance of context

Unfortunately, even the above discussion does not wholly clarify all of the issues involved in questions of comparability and commensurability. Suppose someone wishes to know our feelings about the comparison of two cars, functionally equivalent but differing as to colour. And suppose the context clarifies for us that both the questioner and the respondent are fully aware that the cars are equivalent save for colour. The questioner then asks 'How would you compare the cars with respect to colour?' But still the respondent does not know how to answer the question since we can compare the colour for any of various reasons, including aesthetics, visibility, conformity to some standard, etc. So 'comparability' is, at least in some cases, not just 'comparability of objects with respect to a specified property' but 'comparability of objects with respect to a specified property for some specific purpose'.[5]

4.5 Effects on Finnis and Kuhn

For Finnis this discussion does not bring significant change to what we have already said, although it serves to explain to his critics why instances of his basic values, while incommensurate, may still be seen to be comparable (although in fact what is comparable is not these instances of the values but, rather, some notion of 'value to us'). His seven values are categories, or kinds, among which incommensurability may well apply, as he argues it does. But Finnis rather misdescribes the situation by referring to this as incommensurability: the problem is that the available measures do not measure value, but something else. Additionally, within each value he still has sub-categories which exhibit incommensurability. Therefore he has no obvious method to justify his chosen taxonomy over any other, and his scheme

---

[5]This suggests that what we are really looking at here is several different comparisons that could be made (i.e., that there are, perhaps, several distinctive properties which may be meant by the word 'colour'), the issue being that we still must clarify precisely which comparison we are being asked to make. This notion is supported by the fact that, for at least some of the purposes given in the example, the question of what measure is appropriate in the determination of commensurability also changes since the measure may be different for one purpose than it is for some other purpose. For example, measuring the colour sample vis à vis visibility requires a measurement of human reactions to the colour as stimulus, while measuring the colour sample vis à vis conformity to a given standard requires a physical measurement of reflected light waves. This example may be explained also as an issue of ambiguity in the word 'colour'. No matter which explanation one prefers, it represents a complication that requires clarification.

collapses. For two things to be incommensurate, we imply that they share a common property and that the property is not co-measurable. In most discussions it is never made clear what that common property is, and yet much is said about incommensurability. If we accept that 'value to us' is the property on which comparability rests, then we must recognize that this is also the property on which measurability depends. So the real question comes down to how we are to effect such a measurement. The fact that there are difficulties involved in effecting this measurement is not yet evidence of incommensurability among the values themselves.

For Kuhn, however, some distinctly new problems begin to arise. Comparability is context dependent. But how can two theories be described in a single context unless there is a common language which we can use to describe them? But Kuhn means by incommensurability that there is no such language. Therefore if two theories are incommensurable in the way Kuhn describes, it would seem that they cannot be comparable. So Kuhn's analogical argument that incommensurability does not preclude comparability fails.

It may be objected here that to require two theories to have, at a general level, common language, is too strict a requirement. No doubt it is too strict: in a situation wherein the new theory is more encompassing than the old theory, for example, it would be expected that the new theory would contain language which, according to the old theory, is not even relevant. Clearly, then, it may be the case that the vocabulary of one theory may be a proper subset of the vocabulary of another theory. Regardless, given that 'comparability' is 'comparability with respect to a specified property', we still require a common language at least in regard to that property. So, if two theories are comparable with respect to a specific prediction, there must be available to us sufficient common language to enable us to express that prediction.

It may appear that this critique is similar to one put forth by Scheffler but there are significant differences. Scheffler takes Kuhn to task, both early and late-Kuhn, for failing to distinguish between the view within a paradigm and the more general issue of the choosing of paradigms.[6] Scheffler points out that our inability to fully understand other paradigms from within any given paradigm does not necessarily imply that we cannot, at some higher level, rationally choose among conflicting paradigms. We can, in other words, move up a level to gain a more encompassing view of two rival paradigms and make our choice from there. But there is a problem here. I want to be able to make the stronger claim that comparability at any level is not possible with Kuhn's notion of incommensurability between competing paradigms. My argument makes this stronger claim since it enables us to call into question the possibility of comparability between any two incommensurable paradigms: the lack of a common language precludes our ability to describe the rival theories, and since comparability requires that we be able to do this, then the possibility of comparability is precluded. In any case, it could be argued that if two paradigms are incommensurable in the way Kuhn describes, then it is not possible for there to be, as Scheffler supposes, a higher level at which we may rationally choose between the paradigms. This is because, if there is such a higher level, then we have found a "language, neutral or otherwise, into which both theories ... can be translated without residue or loss."[7] But this is Kuhn's definition of commensurability. So Scheffler's argument can only apply to commensurable paradigms, which are not at issue here.

---

[6]Scheffler, *Science and Subjectivity*, pp. 84-86.

[7]Kuhn, "Commensurability, comparability, communicability", p. 670.

4.6 Context, again

It may be objected that comparability is not wholly context dependent since there are some environments in which no contextual clarification is required. However, this does not hold up to close examination. Clearly there are environments in which no additional contextual clarification is required, but this only occurs where the environment itself provides sufficient information to make the context clear. This point was the purpose of the example given earlier of two figures written on the blackboard. Let's add on to the example. The figure '1' is written in yellow, eight inches high, on a whiteboard, while the figure '7' is written in white, six inches high, on a blackboard. Now four teachers enter the room in succession, look at the board, and ask 'What is the difference between the two figures?' The teachers are an algebra-ist, a geometer, a visual artist, and a philosopher. Now the context in this case is provided by the figures as well as the backgrounds of the different teachers involved, which one may call the implicature. The correct answers appear to be: six; one line; just about everything; it depends. The determination as to which comparison is to made is context dependent.

4.7 Literal and non-literal usages

On each occasion on which it is used, and where we are able to sufficiently explicate the literal usage of the word in question[8], a word is used either literally or non-literally. By 'literal' I mean only that all characteristics normally associated with the term are associated with the term in the usage under consideration, and associated in some way we call 'normal',

---

[8]There are, no doubt, many cases in which there will be disagreement as to whether a particular example represents a literal or a non-literal usage, which suggests that these are cases in which we are not able to adequately explicate the literal usage.

which is to say 'as per the norm or convention governing the use of the word'. By 'non-literal', I mean that some, but not all, of the characteristics associated with the term must be associated in the new usage and/or the characteristics must be associated differently than they are in the literal sense. If all characteristics were associated, and associated in the same way, then the usage would not be non-literal but literal. If none were associated then the usage would not be viable at all but would be simply a mis-use. This mis-use may over time become accepted as a viable use, but becomes neither a literal nor non-literal use of the original term but rather a wholly distinct meaning that happens to use the same word with another meaning.

Some examples of these possibilities may clarify the distinctions I have in mind. If I say 'This computer is a pig' we mean that it has certain pig-like characteristics, perhaps 'big and bulky'. We are well aware, however, that it lacks various other pig-like characteristics, such as 'able to produce piglets and bacon'. This is a case where some, but not all, of the characteristics associated with the literal use of the term are associated in the new usage. If we say 'This computer is a boat anchor', however, we mean that the computer is sufficiently obsolete that its function as a computer has been lost and that it has no further use other than as scrap metal. But when we think of a boat anchor, 'scrap metal' is not one of the characteristics we would normally associate with the literal usage, nor do we seriously suppose that the computer would function effectively as a boat anchor since it is not effectively shaped to do so. This, then, is a case where the characteristics are associated differently than in the literal use since the characteristic in question is key in the new usage but is only indirectly relevant in the literal usage. If we say 'This computer is an effective tool' then we are applying all of the characteristics normally associated with the word 'tool', and applying these characteristics in the usual sense (say, 'instrument or process that improves one's effectiveness in accomplishing a stated task'). This is the literal usage. Finally, if we say 'This computer is a bush' we seem to have simply mis-spoken. There are no obvious characteristics of a bush that apply to computers, so we have failed to effectively communicate anything at all until we have specified the relationship we are trying to draw. No characteristics are associated in any way until we supply more information.

A final example is in order here to demonstrate that, in a non-literal usage, since we are relying on the hearer to associate characteristics differently than in the literal usage, mistakes are quite possible. If I say 'This computer is a rock' I may intend to convey that the computer is solid, stable, and a foundation of my life work. Someone hearing this, however, may associate a very different set of characteristics: perhaps that it has so little value that it couldn't be given away, and that it has a tendency to go down. This illustrates the dangers associated with a non-literal usage, and suggests that in a situation in which we are trying to communicate very clearly, we should avoid dangerous language wherever possible.

As a corollary to this view, we may suppose that the richer is the literal usage of a given word, the richer will be the possibilities for non-literal use. By 'richness' I mean both of the number of characteristics associated with the term as well as of the number of ways the term is related to other characteristics or to other things. I take it that Quine is talking about this latter characteristic in the following passage:

> Thus it is that in theoretical science, unless as recast by semantics enthusiasts, distinctions between synonymies and "factual" equivalences are seldom sensed or claimed. Even the identity historically introduced into mechanics by defining 'momentum' as 'mass times velocity' takes its place in the network of connections on a par with the rest; if a physicist subsequently so revises mechanics that momentum fails to be

> proportional to velocity, the change will probably be seen as a change of theory and not peculiarly of meaning. Synonymy intuitions do not emerge here, just because the terms are linked to the rest of the language in more ways than words like 'bachelor' are.[9]

The complexity of this 'network of connections', then, is part of richness, the other part being the number of defining characteristics of a word. To be a bachelor is to be an unmarried adult male. To define a 'sport', however, is a considerably more complex task since there are many more characteristics that may, or may not, apply to any one particular case, since the notion of a 'sport' represents a family resemblance group.

We have taken 'incommensurable' in its etymological usage to mean 'lacking a common measure'. There are many pairs of things in the world of which it would be most interesting to say that they share a property that is incommensurate. The length of any two ladders, for example, or of a pen and a pencil. And yet these things are invariably not incommensurate. On the other hand, there are many pairs of things in the world of which it would not be particularly interesting to say that they are incommensurate. Knowledge and play, for example. Or hockey and football. And yet it is clear that they do share properties that we both wish to measure and that are co-measurable. Knowledge and play are both things that are pursued by individuals, and an individual may be able to devise a measure to co-measure knowledge and play with respect to that property. Hockey and football are both things that are said to be violent, and we may be able to devise a measure that enables us to measure them with respect to that property. Unfortunately for Finnis, while we may accept that knowledge and play, at the general level, are incommensurate, they are only incommensurate because any two things can only be commensurate with respect to a specified property, so,

---

[9]Quine, *Word & Object*, p. 57.

at the general level, everything is incommensurate. We also, then, must accept that hockey and football are likewise incommensurate. But the notion can then no longer uniquely define his taxonomy of human values.

4.8 What, then, would represent a viable non-literal usage?

If we are taking incommensurability in its literal sense, meaning 'lacking a common measure', then what would represent a viable non-literal usage? Clearly we cannot change 'lacking' to something that doesn't mean approximately the same thing, since the 'in-' prefix requires the notion that we are declining to assert an attribute and no usage at all would be understood if it lacked this characteristic. Similarly, the suffix '-less' to mean 'lacking' cannot be changed to something else even in a non-literal usage. 'Headless' may mean, literally, a body without a head. It may mean, arguably non-literally, a group without a head. But it will never, by itself, come to mean 'having a head'. The privative notion of the prefix 'in-' and of the suffix '-less' appears to be required in even non-literal usages.

What about the phrase 'a common measure'? It appears as if we cannot omit the notion of commonality any more than we could omit the privative notion of the 'in-' prefix. The notion of commonality is what makes incommensurability a two-place property rather than a monadic property, so that leaving out this notion no longer offers the subtle modification that is the hallmark of non-literal usages but, rather, makes such a radical change in the possible usages that it would no longer be understood as a related usage at all.

So it appears that the only modification we can make is to the attribute of 'having a measure'. Kuhn suggests 'lacking a common language' as a non-literal usage. But we have already seen that this ultimately resulted in an unfortunate concept that would have been far more effectively referred to as, say, 'non-inter-translatability'. By way of analogy, what would be an appropriate non-literal usage of 'impossible'? If we accept that 'impossible' means, approximately, 'not possible', then, as with 'incommensurability', we can't mess with the 'not' since it conveys the privative notion that must be retained in any usage. But if we try to change 'possible' to anything else, there always seems to be a more pleasing word for the concept than 'impossible'. For example, should we try to change 'possible' to 'probable', well we already have a word 'improbable'. Interestingly, none of these words (impossible, improbable) appear to have any non-literal usages either, perhaps because they lack the richness referred to earlier.[10]

Now these words, which appear not to allow for non-literal uses, share another interesting characteristic, which is their range of applicability. They may be intelligibly attributed to just about anything at all. We may say of just about anything that it is possible or not, and we have seen that we may say of any two things that they are comparable, or that they are incommensurate (properly speaking, that they share a property which is, or is not, co-measurable). But if the literal use of a word is meaningful when attributed of virtually anything, then we could not distinguish between literal and non-literal uses. But then non-literal usages would not be made since they would not be recognized. Consider 'exists'. Since virtually anything can meaningfully be said to exist or not, no non-literal use of the word could be recognized. Similarly, 'impossible', 'improbable', and 'incommensurable' are not appropri-

[10]In fact, 'impossible' does have at least one non-literal usage, as in "That man is impossible". I will discuss this phenomenon briefly in Chapter 5, where I suggest that it is a dilution of the literal usage.

ate words to carry non-literal uses since their range of literal application is almost unlimited.

In Kuhn's case, of course, the literal usage on which his usage of 'incommensurability' is based is not the etymological usage but, rather, the mathematical usage. What he seems to have in mind is that, just as mathematical incommensurability involves the inexpressibility of the irrationals in terms of the rationals, so do incommensurable scientific theories involve the inexpressibility of certain of the key terms of one theory in the language of the other theory. We need, then, to examine this further to determine if Kuhn's usage is appropriate as a non-literal usage of the mathematical usage.

4.9 Kuhn's usage not a viable analogical usage

It seems clear that Kuhn's use of 'incommensurability' is not a viable analogical use (although, in Kuhn's defence, he does not argue that his usage is analogical, calling it, rather, metaphorical). In analogy, we identify a source and a target, we demonstrate similarities between the two, and then we attempt to infer other similarities based on the demonstrated similarities. But in this case the only demonstrated similarities are the use of the word 'incommensurability' and the definitional phrase that Kuhn uses, viz. 'lacking a common x' where 'x' refers to 'measure' in the one case, and to 'language' in the other. But the choice of the word 'incommensurable' is arbitrary, since it is not literally applied and since no common characteristics have been shown by Kuhn to exist. Since the choice of 'x', which is the only remaining characteristic on which to build the analogy, differs in the two cases, we have failed to demonstrate any similarities which would allow us to infer any further similarities, such as comparability.

An analogy may help to illustrate why Kuhn's usage is not a viable analogical usage. 'Detached' as a term in real estate means 'a dwelling that does not share a common wall with any other dwelling'. Now suppose that we argue for an analogical usage of 'detached' to mean 'lacking a common well' rather than 'lacking a common wall'.[11] Two buildings which are lacking any common walls will also lack a common entry way. But anyone using 'detached' in the analogical sense cannot infer that, on the grounds that, in the literal use, 'detached' implies 'lacking a common entry way', therefore 'detached' in the analogical sense also implies 'lacking a common entry way'. Most urban apartments, for example, are 'detached' in the analogical sense insofar as, since their water source is a piped-in water supply, they lack a common well as they lack any well at all. And yet they do not lack a common entry way. Kuhn's attempt to infer comparability from his usage of 'incommensurability' is likewise unacceptable. This inference is wholly unsupported by his analogical usage, and any attempt to support the comparability of scientific theories must be argued from the ground up.

4.10 Kuhn's usage not a viable metaphorical usage

It seems likewise clear that Kuhn's use of 'incommensurability' is not a viable metaphorical usage. In metaphor we attribute specific characteristics associated with the literal use to subjects other than those to which the literal usage is usually applied. We may say of someone that he is a lion to indicate that he is brave. That the characteristics must be specific

---

[11]I build this example to mimic Kuhn's 'lacking a common language' as a metaphorical usage of the original usage of incommensurability as 'lacking a common measure'. The point is that characteristics associated with the original usage cannot be assumed to flow to any metaphorical usage.

characteristics is clear from the fact that to say of a person that he is a lion will not convey the notion that he is furry, that his mate is a lioness, or that his children are cubs. Even if Kuhn's usage was a successful metaphorical usage, therefore, he could not at all argue from this fact that comparability should also flow as a characteristic to his usage. Kuhn does seem to want to apply the notion of inexpressibility to certain terms of scientific theories, as we discussed in the last section. But even here there are key differences between the mathematical usage and Kuhn's usage. We saw, for example, that the inexpressibility in mathematics is a one-way inexpressibility, since, while the irrationals cannot be expressed in terms of the rationals, the reverse is not always the case. The reals, in mathematics, are the common language in which both the rationals and irrationals can be expressed, while, for Kuhn, the possibility of a common language is expressly disallowed. But then even the key characteristic of the mathematical notion is not brought across into Kuhn's usage.

Again an analogy may help to clarify this. When oil is referred to as 'liquid gold', 'liquid' is used literally while 'gold' is used metaphorically. Now gold has several key attributes, including 'being gold-coloured' and 'being valuable'. Oil is not gold in colour, and it is clear that when we call oil 'gold', we are referring to its value. Gold has many subordinate characteristics, including 'density' and 'malleability'. But none of these subordinate characteristics are taken as being inferrable from the metaphorical reference to oil as gold. In fact oil is quite heavy (even light crude, as you will discover if you try to pick up a barrel of it), but this common characteristic is not inferrable but is merely coincidental. Oil is not malleable at all. The metaphorical usage of a word does not allow us to infer even all of the key characteristics, much less any of the subordinate characteristics.

4.11 Kuhn's usage is in fact a stipulated usage

Ultimately it appears that Kuhn has attempted to use both analogy and metaphor in his use of 'incommensurability'. There is an attempt to use both source and target ('lacking a common metric' vs 'lacking a common language'), which is the basis of analogy, and an attempt to attribute characteristics to subjects other than those common to literal usage, which is the basis of metaphor. Nowhere, however, has he demonstrated why the subordinate characteristic of 'comparability' should be expected to flow to scientific theories in his new usage. He has claimed that the characteristic should flow since it flows in the mathematical usage but we have seen no reason why this should be the case. This is not to say, of course, that the theories he talks about are, in fact, not comparable, since they clearly are comparable in respect to such things as predicting and explaining observable phenomena. But this very comparability seems to belie what Kuhn means by incommensurability.

The fact is that Kuhn's usage of 'incommensurability' is not obviously analogical, since there is no identifiable source or target, and no appropriate mappings, his attempted mapping of 'comparability' as a common characteristic being inferred by Kuhn rather than being a characteristic that supports the viability of the analogy. It is, arguably, not metaphorical since the only common ground between the mathematical usage and his usage is his attempt to bring across the notion of inexpressibility which functions quite differently in his usage than in the mathematical usage. It is not literal since he has stipulated that the definition is 'lacking a common language', which is quite different from the original etymological definition. But this is the clue to what he has done. He has stipulated a definition but pretended a metaphor. But with a stipulated definition there is no reason at all to suppose that characteristics associated with the original meaning should be transferable to the new meaning. One may as well look for legs under the water table or brackets under the continental shelf. In fact these cases are, if anything, more likely to succeed since they are at least metaphorical, while Kuhn's usage is not even that close to the original.

4.12.0 The attribution of the mathematical characteristics

We noted in Chapter 1 that incommensurability in mathematics is made possible only because of certain facts about the specific context of mathematics. I plan now to revisit these facts and characteristics and to apply them to the discussions of both Kuhn and Finnis in order to see whether the attributes that enable mathematical incommensurability have counterparts in these other usages.

In the case of Finnis it seems likely that we might find counterparts, although it will not surprise us frightfully if we do not. Since Finnis's usage is based on the etymological rather than the mathematical usage, enabling characteristics associated with the mathematical usage may or may not be appropriate to support the incommensurability of values. In the case of Kuhn, again, we should expect to find that some would, and that some would not apply. Since Kuhn's usage is clearly non-literal, enabling characteristics may, or may not, be appropriate to support the incommensurability of scientific theories. If we discover, however, that none of these characteristics apply, this will provide further support to the argument that Kuhn's usage is a failed usage, since, again, there will be no common characteristics at all with the mathematical usage that can provide support to his attempt to argue for an effective metaphorical usage. Since Kuhn has specifically argued that the mathematical usage is the basis of his usage, then we might expect to find some commonality here.

4.12.1 Comparability

That incommensurable numbers are nevertheless comparable is the first and, in a sense, the most interesting characteristic, although we have concluded that it is not quite as straightforward as it appeared to be at first. Since 'incommensurability' in mathematics proves not to mean 'lacking a common measure' at all, it proves not to be incompatible with 'comparability' in any case. We have, in our discussions of Finnis, rather uncritically allowed that his values are comparable by allowing his examples of comparability. Our example here has been the scenario of deciding to put aside a tempting cup of coffee in order to rescue a drowning child. Now while this does suggest comparability, three comments should here be made. First, this does not show that two values are themselves comparable but rather that exemplifications, or instances, of two values in a situation may be comparable. As we have noted, it is not clear that human values, at the general level (as opposed to instances in which the values are exemplified) may be said to be comparable. Is knowledge comparable with play? 'In what respect?' is the obvious response. Secondly, we have noted that to exhibit a preference for one instance of a value over another instance of a value does not necessarily demonstrate comparability of values but, rather, comparability of our preferences at a point in time. Thirdly, the implication in the mathematical usage is not only that the numbers are comparable, but that the decision as to position in the usual ordering is objectively decidable. This will be discussed, however, in a specific discussion of objectivity (4.14.3).

For Kuhn we have already suggested that his usage does not in fact allow for comparability at all. If comparability requires a common language, and Kuhn's usage precludes a common language, then comparability is not possible for Kuhn. Kuhn's claim for comparability based on its applicability to the mathematical usage has been similarly shown to be flawed.

4.12.2 No restriction of precision

We noted that any restriction of precision in the mathematical usage precludes the possibility of incommensurability. For Finnis, however, this condition of unrestricted precision does not apply since, for him, the problem is that the available measures do not measure values but, rather, something quite different. Since there is no common measure, and no obvious reason to expect one, precision as to the application of the measure is not relevant. Clearly, at least in most cases, the natural language does not afford us unlimited precision in any case, and certainly not in discussions of human values. But this is why Finnis's incommensurability is so unsatisfactory: while he is likely correct that there is, in many cases, no readily available common measure, there seems to be no good reason to expect that there should be one. We would not expect his values to be commensurate, and they are not. Precision, again, is not relevant.

For Kuhn, yet again we find no match between his usage and the mathematical usage. The mathematical usage requires infinite precision while Kuhn's usage, we have argued, does not even permit the commonality of language. Even if there were a common language we would not expect it to afford unlimited precision since, as noted above, the natural language does not generally afford great precision. However, if no common language is permitted, no precision at all may be expected. We recall that one of Kuhn's phrases here has been to insist that two texts should 'tell more or less the same story'. This is a key deficiency in Kuhn's attempt to build his notion of incommensurability from the mathematical notion. We have seen that any restriction of precision precludes incommensurability in mathematics. But if infinite precision is an absolute requirement in the enabling of incommensurability in mathematics, Kuhn should be able to explain why this is not the case in his usage.

4.12.3 Objectivity

Incommensurability in mathematics is well-defined and well-understood, so that any number of mathematicians (at least those who agree on the notion of incommensurability in the first place) will agree on whether any two numbers are incommensurable and, if they are, on which is the larger of the two. Now there are two reasons to suppose that this will not be the case for Finnis. First, human values do not have a well-defined value independent of any observer. In Finnis's terms, knowledge may have, in general, a higher value to you than does play, while it may be the reverse for me. These values, then, do not have an objective value in the way that numbers do, since the 'value to us' may be different from one individual to another, and, indeed, may differ for one individual from one context to another. Secondly, we said in our discussion of precision that, while Finnis's values lack a common measure, there is no reason to suppose that they should do otherwise. But then we clearly cannot expect the determination of relative values to be objective since the point is that there is no reason to expect a common measure, whereas in mathematics, the ability to measure is the thing that provides objectivity. I don't think I need to argue that this is the way such values really do function.

For Kuhn, again, it seems clear that even the fact of the incommensurability of scientific theories is far from universally accepted. Many do not accept even that his notion of incommensurability is viable much less agree on what instances exemplify its application.

4.12.4 That there are no degrees of incommensurability

Incommensurability in mathematics is a binary switch. Two real numbers are either incommensurable or they are not. This notion seems to fit quite comfortably with Finnis's view of incommensurability. Knowledge and play are incommensurate, as are knowledge and religion. Nothing can commensurate these three values and any two are just as incommensurate with each other as are any other two. As there exists no measure in the first place, there seems to be no sense in which incommensurability is a matter of degrees.

For Kuhn, however, it appears that incommensurability may well be a matter of degree. If 'incommensurability' means 'lacking a common language', it would seem that theories may be 'lacking a great deal of common language' or, rather, 'lacking a modest amount of common language'. Imagine, for example, three theories, T_1, T_2, and T_3. Suppose T_1 was replaced by T_2 which, in turn, was replaced by T_3. Now, particularly if T_1 contains vocabulary which is obsolete in today's terminology (say, for example, that it uses such notions as phlogiston), and if T_2 does not contain such obsolete vocabulary, it would seem appropriate to claim that T_1 and T_3 are more incommensurable than are T_2 and T_3 since, by assumption, T_2 and T_3 share a great deal of common language while T_1 and T_3 share very little. But then Kuhn's notion allows for degrees of incommensurability, and we find again discrepancies between Kuhn's notion and that used in mathematics.

4.12.5 Incommensurability is non-transitive

Two numbers, both incommensurable with an integer, may, but need not, be incommensurable with each other. Finnis would argue that this fits very nicely with his program. If the two values, each incommensurate with a third, are representatives of the same class of value (i.e. both contained in the same category of the seven values), then they are commensurate with each other, otherwise not. (We have argued that Finnis is wrong in general here since we have found instances within a single value that are yet incommensurate with each other. But we may accept that there could be a set such that two of the values are incommensurate with a third and yet commensurate, or, alternatively, incommensurate, with each other.)

For Kuhn this is also the case. For Kuhn to say that two theories, T_1 and T_2, are incommensurate with a third, T_3, is to say that T_1 and T_2 are contained in paradigms which are incommensurate with the paradigm containing T_3. Now T_1 and T_2 are either in a single paradigm or they are in separate paradigms. If they are in the same paradigm, then they are commensurate with each other (i.e., they are not 'lacking a common language'). If they are in separate paradigms then they are incommensurate with each other. For Kuhn, therefore, incommensurability is also non-transitive.

4.13 Summary

We conclude, therefore, that some key characteristics, notably those around issues of precision and objectivity, appear to provide a good explanation of why Finnis's usage is so unsatisfactory. We conclude further that there appears to be no characteristics common both to the mathematical usage of 'incommensurability' and to Kuhn's usage that can provide any significant level of support in his attempt to argue for a viable non-literal usage. While both usages are shown to be non-transitive, this is not sufficient to support an argument for commonality.

We have failed to discover any interesting usage of 'incommensurability' beyond a very specific usage in mathematics which adds an additional requirement to what we described as our paradigm literal usage (i.e., the etymological usage). We have failed to find any viable non-literal usage at all.

5.0 Summary comments

Where, then, does this study of a single word leave us? What had seemed like a simple co-opting of a term from another discipline has led us into a complex analysis that leaves us doubting the efficacy of the co-opted usages. We have argued that these usages fail because they have, in some sense, confused rather than clarified our thinking on the relevant topics. And yet usages other then the etymological and mathematical usages do seem to exist. One hears it said often enough these days that the salaries of business executives are incommensurate with their responsibilities. Now this is clearly at odds with the etymological usage. The same thing could be literally said about the wages of labourers, since we do not have available to us the common measure that will enable us to measure both a person's earnings and their responsibilities, so the fact that the comment is made only about executives' salaries suggests a decidedly non-literal usage. In this usage, common enough in common parlance, 'incommensurate' means something like 'disproportionate' or 'out of line'. The missing measure is not the one that enables measurement of earnings and responsibilities but, rather, that which enables measurement of a business executive's salary with that of a lower paid person. Here, too, all that is being said is that the relative sizes of the numbers are disproportionate, not that a wholly different scale is being used. It is as if we were to say that an apple is incommensurate with the earth since we would measure one in inches (or centimetres) while we would measure the other in miles (or kilometres). Since each measurement may be defined in terms of the other, neither of these cases represents incommensurability in the etymological sense, but are usages that have gained currency in the natural language that allow one to describe such differences in magnitude (orders of magnitude, as one might say) as instances of incommensurability. This phenomenon, which is a sort of dilution of meaning (in the sense that the word's meaning goes in the same general direction as the original meaning but falls rather short of it) may be seen also in words such as 'unique', originally meaning 'one of a kind', but now often used to mean 'unusual'. Similarly, 'awesome' has been diluted to mean something like 'impressive'. It is, of course, arguable as to whether the new usage is wrong or not. Certainly it is different from the original meaning. We may note that Ramberg's program seems to offer a good explanation of the mechanism that causes such subtle shifts in meaning, as well as a description of how language use evolves in such a way that we are ultimately able to get past these minor perturbations in the development of the language.

We have seen that Finnis's usage must be seen as an attempt to use the word in a sense close to the etymological usage. It ultimately fails, not just because it is not literally true of the things to which he attempts to apply it, but because it is not uniquely true (in the literal sense of 'unique') of those things. Since the characteristic of being incommensurable is, for him, the differentiating characteristic that defines his values, the fact that the characteristic fails to uniquely define those values renders it ineffective to his purposes. Diluted usages of 'incommensurable', perhaps used to mean 'incompatible' or 'incompossible' will clearly not fix the problem for Finnis. If the stronger usage does not define his seven values, it is because the word does not give us seven but, rather, many more than seven. Dilution of the defining characteristic, therefore, will not offer fewer values, but even more than the stronger usage. In any case, we have seen that 'incompatible' or 'incompossible' are not effective for Finnis's purpose since many things exemplify more than one of his seven values. But if a single thing can exemplify multiple values, in what sense could we say that those values were incompatible or incompossible?

Finnis's usage suffers further by being a usage that runs counter to the rules of implicature for the word in question. Incommensurability is of interest only in situations in which we would otherwise expect the things in question to be commensurable. We do not normally say of non-physical objects that they fail to share a common colour, even though this may well be literally true, as is Finnis's assertion of incommensurability among the list of human values for which he argues. To say that two things are incommensurable is to say not just that they are incommensurable but to suggest, further, that one would expect them to be commensurable. In this sense Finnis's usage further misleads our inquiry since the hidden assumption is not, in this case, true. It would be as if a mathematician were to assert mathematical incommensurability between numbers and brackets: it may be literally true, since the two cannot be in rational proportion in any obvious sense, but it would be a usage that is either wrong (in the sense that it violates the rules of implicature) or, at least, confusing. 'Incommensurability', in short, is a technical term in its mathematical usage and, if we are to be understood, we must obey the rules that govern its usage.

Kuhn's usage, on the other hand, is admittedly a metaphorical usage, so he has the prerogative, it being his own usage, to determine what are the rules that govern that usage.

We have suggested that this usage might be better described as 'non-intertranslatability' or, more properly, à la Ramberg, 'temporary confusion due to meaning shift such that significant translation is required' in order for proponents of competing paradigms to effectively communicate. That this is not a notion entirely foreign to Kuhn may be seen in the following passage:

> Briefly put, what the participants in a communication breakdown can do is recognize each other as members of different language communities and then become translators.[1]

This process is then described as being "...what the historian of science regularly does (or should) when dealing with out-of-date scientific theories."[2] But if this is the technique that, in at least some cases, enables the historian of science to turn the gestalt-switch, then why should the technique not be available to the rest of us, whether for new or for obsolete theories?

We have made much of the problems encountered by Kuhn in his attempt to argue for comparability between paradigms on the ground that there exists sufficient common language to make the comparisons. Comparability is always context-dependent, and if there is no language that enables a common context, then there can be no comparability. Kuhn, of course, argues that there is some lack in our ability to translate between incommensurable paradigms. And yet we find him allowing that "...few will be persuaded without some recourse to the more extended comparisons permitted by translation."[3] But if the comparisons are permitted, or enabled, by the translation, then surely we may say that translatability gives rise to comparability. But if comparability is, as Kuhn argues, central to his notion of paradigms, and

---

[1]Kuhn, *The Structure of Scientific Revolutions*, p. 202

[2]Ibid.

[3]Ibid., p. 203

translatability enables comparability, then translatability may be seen as the real issue here. But if this is the case, why bring in such a confusing word as 'incommensurability' (more properly, 'incommensurability in some metaphorical sense based on the mathematical usage') rather than 'non-translatability'? Further, no defence of Kuhn may suggest that by 'translation' he means something like 'word-for-word translation'. He acknowledges that "...the price [of translation] is often sentences of great length and complexity"[4] even though he also asserts that the requirement for holding texts to be equivalent is only that they should "tell more or less the same story".[5] And, again, we see his claim that "the lexical structures employed by speakers must be the same"[6] and that "taxonomy must ... be preserved".[7] But, coming back to the historian of science, this surely implies either that translation is sufficient to render an adequate description or else our historian is not able to do what he apparently does. As he clearly does what he does, we must allow, again, that the real issue here is translatability.

A major problem in reading Kuhn lies in trying to understand the relationship between revolutions and incommensurability. Is a revolution to be defined as a shift from one paradigm to another that is incommensurable with it or is incommensurability to be defined as the differentiator among revolutionary paradigms? We saw in our discussions of revolutions in mathematics the difficulties found in defining what should constitute a revolutionary development. Is it simply something completely new and different or must it discard some previously

---

[4]Ibid.

[5]"Commensurability, comparability, communicability", p. 672.

[6]Ibid., p. 683.

[7]Ibid.

held view? The Copernican cosmology seems to embody both of these aspects and yet it is not clear that translatability was an issue here at all (i.e., it is arguable that incommensurability in Kuhn's sense does not arise as an issue in this case). Non-Euclidean geometries were different and new and yet it is arguable that they did not discard the previously held theory but, rather, supplemented it. In addition there was not any obvious difficulty for the proponents of the new theory to express the old theory in their terminology. It is ironic that, in a book by a philosopher entitled *The Structure of Scientific Revolutions*, the notion of what constitutes a revolution is nowhere closely defined and is only loosely given by a series of examples that closely suit the author's purposes.

One may suppose that, where formal systems are involved, any addition or deletion of an axiom or postulate could, perhaps, be deemed revolutionary. This is the case in both Riemannian and Lobachevskian geometries, where a postulate was replaced. Similarly Einstein is reputed to have modestly said "I simply ignored an axiom". But we have argued that, at least in the case of the non-Euclidean geometries, this deletion of an axiom did not result in the inability to express either paradigm in the language of the other, since the Euclidean system was still expressible in the language of the non-Euclidean system. A theorem true in one system, then, may be true or not true in another. But this does not yet meet Kuhn's requirement for incommensurability. So even in formal systems we do not seem to happen upon an easy definition of what constitutes a revolution.

Among non-formal systems we have similar issues. If specialists in biological taxonomy should suddenly conclude that fishes evolved from primates, I suppose that would be revolutionary. Should they decide that birds evolved from dinosaurs, they may be revolutionary. Should they marginally reclassify some recently discovered specimen of little interest even to specialists, I suppose we would say that the reclassification is not revolutionary. But this suggests that what counts as revolutionary is not determined by what is out there in the world so much as it is determined by how it affects our previously held beliefs and theories. But if what we accept as revolutionary is a largely subjective phenomenon, then why should we suppose that incommensurability, in Kuhn's sense, is involved? Kuhn says:

> The conversion experience that I have likened to a gestalt switch remains, therefore, at the heart of the revolutionary process. Good reasons for choice provide motives for conversion and a climate in which it is more likely to occur. Translation may, in addition, provide points of entry for the neural reprogramming that, however inscrutable at this time, must underlie conversion. But neither good reasons nor translation constitute conversion, and it is that process we must explicate in order to understand an essential sort of scientific change.[8]

But conversion, surely, is a psychological process, just as 'revolutionary' seems to be a psychological description. But if this is the basis of what constitutes a scientific revolution, there is still no reason whatsoever to assert incommensurability, in Kuhn's sense or in any other.

Some additional comments should be made concerning the related issues of objectivity and precision. We saw in Chapter 1 that these were two key elements in the mathematical usage of 'incommensurability': the fact that the ascription of incommensurability was sufficiently well defined to enable virtually all observers to agree on its application; infinite precision, which turned out to be a sine qua non of mathematical incommensurability itself. But neither of these characteristics applies to Kuhn's usage of the term (nor, incidentally, to Finnis's usage).

---

[8] *The Structure of Scientific Revolutions*, 2nd edition, p. 204.

For Finnis it is clear that objectivity is an issue, since not everyone agrees even with his list of values. In an informal system (as opposed to the formality of, say, a mathematical system) there is no pre-established agreement on the application of measure and so we see disagreement not only on the application of measure but even on which subjects are appropriate subjects to be subject to the measure. That precision is an issue must be clear from the fact that the measure to be applied is not an objective measure at all but is, by definition, subjective. A human value is, by definition, value to a human, or to some group of humans. But then our judgement of the value seems to be, at least largely, subjective. There is no obvious way to garner agreement as to precision since value can only be 'value as I understand it', or 'value as you understand it', with 'you' in this case representing either and individual 'you' or a collective 'you'. Even this understates the complexity of the issue, since 'value to me' is really 'value to me at place P and time T in circumstance C', since 'value to me' is ever changing. Value, then, cannot be expected to be subject to infinite precision, even if we allow considerable value objectivity to Finnis.

For Kuhn's case we find even greater problems. If objectivity in the mathematical usage of incommensurability affords us the expectation to suppose that we will be able to decide, in most any case, on whether or not two given numbers are in integral ratio, then in Kuhn's case it would seem to require the ability to decide, in any case, on whether or not two given theories are expressible in terms of the vocabulary of the other. Similarly, whatever level of precision we demand in the mathematical usage, then precision, for Kuhn, ought to hold him to, at least, significant precision in the application of the language. But language, even scientific language, does not always afford such a level of precision. Nor does Kuhn expect it to, as is suggested by his phrase maintaining that equivalent texts will 'tell more or less the same story'. Further, we find that the observations which we use to validate a theory are also not generally extremely precise since these data are subject to the (at least) five kinds of observational errors described by Suppes in Chapter 1.1.

Ultimately the best case that can be made for Kuhn's view is that periods of normal science are occasionally interrupted by upheavals that change some of the basic notions within a defined field; that scientists accustomed to the established way of thinking may have difficulty understanding the new approach; that, since the meaning of key terms may have changed, recognition of this is required to enable full understanding of the new paradigm; that the psychological process of understanding this new paradigm may be difficult and, in some cases, even impossible; that, where the new paradigm is significantly better than the old paradigm in certain ways, it will, over time, come to be accepted as the new normal science and scientists will then try to fit the observed data to the new theory in many and varied experiments; that the scientists in the new paradigm, at some level, see different things when they look at the world than they did before. What is unacceptable, and, over time, was largely explained away by Kuhn is that proponents of the old and new paradigms must talk at cross purposes; that there is an inherent incommensurability between paradigms; that scientists see a different world after a paradigm change; that scientific progress is non-cumulative. As Steven Weinberg recently wrote:

> But Kuhn's view of normal science, though it remains helpful and insightful, is not what made his reputation. The famous part of his work is his description of scientific revolutions and his view of scientific progress. And it is here that his work is so

seriously misleading.[9]

On all counts, I fear, there is no demonstrated useful application of 'incommensurability' beyond that in mathematics. Comparability and commensurability become contextual characteristics such that, wherever one is present, the other seems to be also available to us. Even in mathematics we find that 'incommensurability' has not been recognized as applying only in a very specialized sense, and with a crucial added condition. Since incommensurable numbers are not lacking a common measure we must allow that this usage is quite distinct from the etymological usage. My argument, again, is not that such usages are wrong. Such usages do subject us, however, to some degree of risk. If, then, there are avenues open to us that do not subject us to such risk, we should take them. In all of the usages investigated here there are indeed alternative avenues open to us.

---

[9]Steven Weinberg, "The Revolution That Didn't Happen" in The New York Review of Books (October 8, 1998), p. 51.

A.0 Appendix

A number of philosophers have devised theories of incommensurability in the philosophy of science that take an entirely different approach than those of Kuhn and Feyerabend. Rather than looking at the internal subject matter of a theory, some have preferred to compare theories based on their applications, their consequences, and the predictions that the theories entail. Three of these philosophers will be discussed, under the heading 'Incommensurability of Consequences'. Others have devised theories of incommensurability that describe incommensurability as an issue in the abilities of people to communicate with each other. Some of these views are discussed under the heading 'Incommensurability and Communicability'.

A.1 Incommensurability of Consequences

Hintikka is sharply critical of the kinds of readings we have examined in this work: "...there is no single sharp logical explication of the notion of incommensurability in the literature".[1] I think we can agree with Hintikka on this point, which is really the impetus for the current work overall. The notion of incommensurability is used again and again as if it

[1]Hintikka, *On the Incommensurability of Theories*, p. 26.

were a perfectly ordinary word which is well understood As Hintikka recognizes, this is scarcely the case. He argues that translatability cannot be a condition of commensurability since incommensurable theories have in fact been compared, suggesting that he too supposes, at least, that incommensurability entails non-comparability. (While Kuhn would reply here that incommensurability does not entail non-comparability, we have also seen that Kuhn's own argument for comparability is flawed as it stands.) Hintikka offers his own 'sharp logical explication' of incommensurability as follows:

> What can it mean then to say that [two theories] are incommensurable? Clearly, it means that their respective consequences are somehow so different that they do not enable a scientist to compare them with each other.[2]

> ...T1 and T2 are (totally) incommensurable if and only if there is no question Qi in a set of relevant questions {Qi}, i ∈ q, which is answerable on the basis of both of the two theories.[3]

This, then, is a complete reversal of Kuhn's views since theories that are incommensurable in Kuhn's usage become largely commensurable in Hintikka's view, and vice versa. If we take two theories such as Newtonian physics and relativistic physics, Kuhn's view suggests that they are incommensurable since key terms in one are not expressible in the language of the other, while Hintikka's view suggests that they are largely commensurable, since there are, presumably, large numbers of questions which are answerable on the basis of both of the two theories. If we take two theories which have no apparent common subject matter, however, Hintikka's view maintains that the theories are largely incommensurable since there is not a large set of questions answerable on the basis of both of the two theories, while Kuhn's view,

---

[2]Ibid., p. 28.

[3]Ibid., p. 29.

presumably, maintains either that incommensurability is not an issue since issues of translatability do not arise where there is no common subject matter, or that they are commensurable since translatability is not a problem simply because the subject matter differs, i.e., they are not untranslatable simply because they lack any common subject matter, so that we can easily map one theory into the paradigm of the other theory since there are no issues of translatability and so no issues of incommensurability (i.e., the two theories do not touch each other, so to speak).

Other observations on Hintikka's view again point out many differences. His view makes place for context, since incommensurability is, by definition, relative to a set of specified questions. It is not quite clear how we determine exactly what are the set of relevant questions, although we can allow that such a list may be, if difficult, at least possible to collect. His view does require a notion of degrees of incommensurability, since it is the ratio of common answers to the specified questions that determine incommensurability, so that we may have a great deal of incommensurability or very little incommensurability. It is clear that Hintikka has recognized this, since in the passage cited above he includes the word 'totally', implying that there may be total or only partial incommensurability.

Ultimately, however, while Hintikka's view seems viable in theory, it is not made clear in what way it might be usefully employed. More to the point for us, however, it is not clear why Hintikka would wish to refer to the phenomenon as 'incommensurability'. This usage offers a new phrase for the term. We have seen 'lacking a common measure' and 'lacking a common language'. Hintikka's usage would seem to mean 'lacking common consequences'. We would normally wish to say that such theories were unrelated, or unconnected, or that they applied to different areas. I fail to see why 'incommensurability' would be suggested as the appropriate nomenclature.

Sam Rakover's approach is again markedly different from Kuhn's, while following a thread somewhat similar to Hintikka's program. While it is not entirely clear just how he uses the term 'incommensurable', his interest seems to be in devising a method of comparing, and ultimately, he argues, commensurating, what Kuhn would call incommensurable theories. This, apparently, is based on the notion that we are thereby able to rationally compare incommensurable theories:

> I propose an approach that is the reverse of the thesis of incommensurability, which I shall call the commensurability approach. It proposes that a metatheory can be developed for rationally comparing incommensurable theories. The justification for this approach can be summarized as follows. First, I shall argue that there is no decisive argument proving that the incommensurability thesis is correct, so that there exists a possibility of developing a metatheory for comparing theories belonging to two different paradigms. Second, the realization of this possibility depends on factors such as theories being multidimensional, and the success of such an endeavour is dependent on certain confirmatory empirical tests. And third, the very fact of having successfully developed a metatheory would constitute an empirical support for my proposed approach by demonstrating that it is possible to compare a given set of incommensurable theories rationally and relevantly.[4]

He goes on to develop an example that takes seven mind-body theories for comparison. He then devises eleven yes/no category questions (e.g., "Mind is viewed as a theoretical question?"), he makes a table with the appropriate entries for each question as it applies to each of the theories, and finally he produces a table showing, for any two theories, the number of differing responses.

Now it is not entirely clear whether Rakover is thinking in terms of 'incommensurable'

---

[4]Rakover, *Incommensurability*, p. 103.

as meaning 'lacking a common language' or, rather, as 'lacking a common measure'. If the former, well Kuhn has maintained from the start that comparability is not compromised by incommensurability, so Rakover's program becomes simply a drawing out of Kuhn's theory that Kuhn could support as proof of the comparability of theories. It is important to note, however, that it seems rather more likely that Rakover is thinking of 'incommensurability' as meaning 'lacking a common measure' and that he then wishes to show that incommensurability will not occur since he has been able to devise the measure. But Kuhn will now argue that the term as applied to theories really means 'lacking a common language', which cuts Rakover off at the knees. Kuhn would argue that the category questions are not viable since, even if the theories in question used the same words, the meanings of key terms would not be consistent from one theory, or paradigm, to another.[5] In this event we are not applying, according to Kuhn, the same question to the different theories but, rather, the question applied to each theory is really a different question. Therefore, counting up the differing responses is meaningless and useless. This shows, once again, that Kuhn encounters real and substantial difficulties in arguing for comparability across paradigms. If Rakover's description of the mechanism that enables comparability across paradigms is not admissible by Kuhn's own program, then Kuhn still owes us a description of what this mechanism is and how it can work without suffering the ravages of the incommensurability for which his own program argues.

Another concern with Rakover's view is the subjectivity involved in the choice of the category questions. For Hintikka this is not an issue since for him incommensurability means

---

[5]Presumably Kuhn would not level this criticism against Hintikka, since the theories involved , concerning different subject matters, would not contain inconsistent meaning shifts of key terms but, rather, key terms that are, simply, different.

'incommensurability with respect to a given set of questions'. Rakover, however, is striving for a 'rational and relevant' way to compare theories so he needs to specify a rational and relevant way to determine the category questions. Further, this is not simply a case where he can argue that intelligent cooperative scientists will always be able to quickly reach agreement since, according to Kuhn, these are precisely the kinds of questions about which proponents of competing paradigms will disagree. In fact Kuhn's first point about the indicators of incommensurability is precisely this:

> In the first place, the proponents of competing paradigms will often disagree about the list of problems that any candidate for paradigm must resolve. Their standards or their definitions of science are not the same.[6]

But then Rakover does need to explain the mechanism whereby he determines his list of rational and relevant questions.

Hin-Chung Hung's notion is again different, relying on the diversity of the predictions of the theories in question to determine incommensurability:

> Two theory-languages are incommensurable if and only if they are inconsistent with each other ... [and] if two theories (theory-languages) are inconsistent (whether weakly or strongly), they would share the same external subject-matter, but differ in internal subject-matter. That they make diverse predictions is a necessary and sufficient condition for their internal subject-matter to be distinct.[7]

So theories are incommensurable if they are inconsistent with each other, inconsistent if they differ in internal subject-matter, and they differ in internal subject-matter if they make diverse predictions. That is to say, if two theories each make diverse predictions about the same external subject matter then they are incommensurable. But this does not differentiate between

---

[6]Kuhn, *The Structure of Scientific Revolutions*, p. 148.

[7]Hung, *Incommensurability and Inconsistency of Languages*, p. 347.

what others have put forth as incommensurable theories and any two theories that simply make subtly diverse predictions. For example, if you have a theory that distilled water at sea level will boil at 211°F and my theory says it will boil at 213°F, then they make diverse predictions and, according to Hung, are incommensurable since their external subject-matters are the same. But this seems to cast the net too wide, since it does not exclude theories which differ marginally only on specific points from each other. Further, it does not exclude as incommensurable those theories which are radically different from each other and yet which do not differ greatly in their predictions (e.g. Copernican theory in its early stages as compared to the later Ptolemaic theory with its complex of epicycles). For Hung, therefore, incommensurability seems to mean 'dealing with the same subject-matter but differing in consequences'. Since we do not normally compare theories that do not deal in, at least approximately, the same subject-matter, however, this ultimately appears to equate 'incommensurable' with 'different'. Again, while Hung may define his words as he chooses, it is not at all clear why he would wish to use a less widely understood term when there is already available a term which is perfectly well understood.

A.2 Incommensurability and Communicability

The theme of this section is the effect of incommensurability on our abilities to communicate with each other. We saw briefly in Section 3.1.1 that Ramberg argues for a notion of incommensurability as a symptom of a language temporarily confused by meaning shift:

We can give an account incorporating Kuhn's claim that incommensurability is a matter

> of meaning-change by construing incommensurability as part of the semantic evolution of a language... We can, in other words, give content to the idea of a semantic obstruction other than intranslatability.[8]

> Incommensurability, as a communication breakdown, can be understood as a breakdown of linguistic conventions, caused by changes in use that are too abrupt to be absorbed smoothly, or changes that a particular set of conventions are too rigid to accommodate. Semantically, then, incommensurability is a disruption in the ongoing interpretation-through-application of our linguistic conventions.[9]

Now if incommensurability is a temporary communication breakdown, Ramberg seems to suppose that the issue would not normally be thought of in terms of translatability so much as, say, comprehension; since the meaning shift is only partial, and temporary, then the problem is merely one of accommodating ourselves to a new usage. Ramberg notes here the surprising implication that incommensurability between natural languages cannot exist:

> To regard incommensurability as a relation between existing linguistic structures of conceptual schemes, is to fall back on the notion of intranslatability. Since we cannot make sense of this notion, it makes no sense to think of two different natural languages as being incommensurable. The reason is that incommensurability is a diachronic relation, not a synchronic one; it is not a relation between structures, but a symptom of structural change.[10]

Now Ramberg's discussion is quite interesting and the phenomenon he describes seems to be quite widespread. There are words that are widely used today that did not exist fifty years ago, the entire vocabulary of computers providing a good example. There are words used today that have a very different meaning than they did only twenty-five years ago. There are even words used today that seem to spring into use almost overnight, some of which disappear

---

[8]Ramberg, op. cit., p. 129.

[9]Ibid., p. 130.

[10]Ibid., p. 131.

almost as quickly, some of which are more lasting. All of these cases represent changes of linguistic usage that each, in their time, required some adjustment on the part of users of the natural language in order to accommodate the new usage. What is not clear, however, is why Ramberg wishes to use 'incommensurability' as the term to describe this phenomenon. We have seen that the etymological usage of the term means 'lacking a common measure'. Kuhn used the term to mean 'lacking a common language'. Ramberg apparently wishes to use the term to mean 'temporarily confusing'. It should also be noted that Ramberg's view would appear to commit him, like Hintikka, to the notion of degrees of incommensurability, since it would seem appropriate to say of a given term at a specified point in time 'A couple of years ago that was very incommensurable, but it's not so much so now'. This because incommensurability, being a symptom of structural change, must be quite pronounced when the change is first confronted but must lessen as the change is accommodated in the natural language.

However, as interesting as is this theory of the evolution of a linguistic structure, it still is not clear that the issue here is not one of translatability. One may say that the issue is one of comprehension, but this does not necessarily take us out the realm of translatability. To say that incommensurability is a symptom of structural change rather than an issue between two linguistic structures also does not imply that the issue is not one of translatability. One may as easily say that the linguistic structure prior to the introduction of the evolutionary symptoms of incommensurability represents one structure and that the linguistic structure after this introduction represents a new and different structure, and that the issue is precisely how to translate from the pre-incommensurable structure to the post-incommensurable structure.

Ramberg seems to suppose that the boundaries describing different structures are well defined and stable, while this evidently is not the case. Is American English one structure and European English another? How about Quebec English and Texas English? While Ramberg's notion nicely describes the evolutionary meaning shifts in a language it is not apparent that the issue is not still one of temporary intranslatability from one linguistic structure into another.

Mario Biagioli's discussion centres around a debate between Galileo and his Aristotelian contemporaries over the notion of buoyancy. The Aristotelians claimed that they literally could not understand what Galileo was saying, which Biagioli takes to be evidence of incommensurability. He points out that in other cases of discussions between proponents of competing theories we do not necessarily find this lack of understanding:

> On the other hand, we find instances in which communication was maintained across radically different positions when the practitioners shared comparable socio-professional identity. For instance, Kepler (a Copernican), Magini (a Ptolemaic), and Tycho (a Tychonic) - all technical astronomers - were able to sustain a long dialogue although their work presented or reflected radically different cosmologies. [11]

This does not mean, however, according to Biagioli, that the opposing views are not incommensurable but rather that the astronomers in question are in some sense bilingual, that their vocabulary is a shared vocabulary since they are all technical astronomers. Biagioli continues:

> However, if bilingualism offers a way *around* incommensurability, it can not resolve it. To be *bi*lingual does not mean to be *meta*lingual. Bilingualism makes one *aware* of incommensurability, but does not solve it.[12]

Biagioli's detailed discussion of the case involving Galileo and the Aristoteleans makes it very

---

[11]Biagioli, *The Anthropology of Incommensurability*, p. 186.

[12]Ibid., p. 202.

clear, however, that this was a debate where personal animosities ran very high and the rhetoric was flying from both sides. This makes it extremely unclear as to whether the claim of the Aristoteleans of not being able to understand Galileo was hyperbole or bona fide evidence of incommensurability. In general, for Kuhn and for Biagioli, we should be looking for evidence of incommensurability from sources other than those in which the excitement of the battle may have distracted the participants from close attention to the points of the matter at hand.

It is also interesting to note Biagioli's example of the astronomers being able to understand and to debate each others' cosmologies quite readily. This appears to be a case in which radically different views (which, as we have seen, Kuhn has claimed are incommensurable) are expressed by a common vocabulary in which it can be argued that no meaning shift has occurred: 'sun' and 'earth' still mean 'sun' and 'earth', and these can be referred to ostensively. The phrase 'a orbits b' still means 'a orbits b' and whether 'a orbits b' or 'b orbits a', it is difficult to imagine the meaning shift that would result in one being able to understand one without being able to understand the other. Now Kuhn would presumably argue that meaning shift has in fact occurred since either the meaning of 'sun' includes its relationships with other bodies and/or, since the meaning of 'sun' involves in part the kind of thing it is (i.e. that it is a star rather than some other kind of thing). However it is still difficult to see how this makes a difference here since these relationships, or categories, seem to be implicitly expressed in the phrase 'a orbits b', which seems to be available as a simple description, perhaps even a translation. It is not quite clear how Biagioli himself accounts for this case, however, since it is less than obvious that having a shared vocabulary is quite the same thing as being bilingual.

Biagioli's view of the efficacy of bilingualism in general also does not seem to be particularly helpful. If, in saying that bilingualism does not solve incommensurability he means that it does not decide for us for one view over the other, then this seems true but unenlightening. Air travel provides us the capability to rapidly travel great distances but does not decide for us where to go. Nor do we expect it to. Similarly we would not expect bilingualism to decide for us in favour of one view over another. If Biagioli means something else by the phrase 'solving incommensurability' than 'deciding for one view over another' it is not clear what this might be. He cannot mean 'recognizing incommensurability' since he has said that bilingualism makes one aware of incommensurability, which I take to mean that it enables one to recognize incommensurability where it exists. He also maintains that bilingualism offers a way around incommensurability. What, then, would solve incommensurability apart from recognizing it and offering a way around it? If he just means that we cannot explain it to another person who is not bilingual, this is not a very interesting comment, since there are presumably many situations encountered where a thing cannot be fully explained in language to another person since the other person's language and background may be different from ours. But if we can recognize incommensurability, and are bilingual (in Kuhn's terms, are able to 'go native') then it seems that we do solve incommensurability. This is what the historian of science does in his work. That we cannot necessarily describe the experience of 'going native' to someone who has not done so scarcely seems like much of a limitation.

The general tenet of Anthony Matteo's paper is that Kant's notion of categories, as propounded by Grayling and Marechal, provides the structure needed to ground language use while permitting sufficient variety in usage to explain the ways in which language may be misunderstood. Incommensurability, then, must work within the confines of the categories and should not limit our ability to understand, perhaps with significant effort, other incommensurable views:

> Rather ... it should liberate us from the structures of ethnocentrism, scientism, fundamentalism, or any form of dogmatism that erroneously enshrines a particular, historically conditioned perspective as authoritative and definitive. Purged of dogmatic presuppositions, we can then enter openly into a free and unencumbered dialogue with the rich and multiform sets of beliefs and practices by which human beings have struggled to make their way in the world. [13]

This is very beautiful but Matteo never explains how some modernized notion of categories will help us to purge our conditioned perspective. Is there an unconditioned perspective? If so, then how do we get there? If not, then how do we recognize the conditions on our conditioned perspective? Unfortunately, key questions remain here.

---

[13]Matteo, *Grounding the Human Conversation*, pp. 240-241.

BIBLIOGRAPHY

Biagioli, Mario. "The Anthropology of Incommensurability". *Studies in History and Philosophy of Science*, 21(2) (1990), 183-209.

Bishop, Michael. "Why the Semantic Incommensurability Thesis is Self-Defeating". *Philosophical Studies*, 1991, 343-356.

Carroll, John B. *Language, Thought, and Reality: Selected Writings of Benjamin Lee Whorf*. Cambridge: Technology Press of Massachusetts Institute of Technology, 1959.

Cedarbaum, Daniel G. "Paradigms". *Studies in History and Philosophy of Science*, 14 (1983), 173-214.

Chang, Ruth. *Incommensurability, Incomparability, and Practical Reason*. Cambridge: Harvard University Press, 1997.

Chisholm, Roderick M. *A Realistic Theory of Categories*. Cambridge: Cambridge University Press, 1996.

Churchill, John. "If a Lion Could Talk". *Philosophical Investigations*, 12 (1989), 308-324.

Churchill, John. "The Bellman's Map: Does Antifoundationalism Entail Incommensurability and Relativism?". *The Southern Journal of Philosophy*, 1990, 469-484.

Cohen, Eric and Ben-Ari, Eyal. "Hard Choices: a Sociological Perspective on Value Incommensurability". *Human Studies*, 16(3) (1993), 267-297.

Davidson, Donald. "On the Very Idea of a Conceptual Scheme". *Proceedings of the American Philosophical Association*, 47 (1974), 5-20.

Devitt, Michael. "Against Incommensurability". *Australasian Journal of Philosophy*, 57 (1979), 29-50.

Ellis, Anthony. "Deontology, Incommensurability, and the Arbitrary". *Philosophy and Phenomenological Research*, 52(4) (1992), 855-875.

Feyerabend, Paul. *Against Method*. London: New Left Books, 1975.

Feyerabend, Paul. "Putnam on Incommensurability: Comments on 'Reason, Truth and History'". *British Journal for the Philosophy of Science*. 38 (1987), 75-81.

Finnis, John. *Natural Law and Natural Rights*. Oxford: Clarendon Press, 1980.

Fuller, Steve. *Social Epistemology*. Bloomington and Indianapolis: Indiana University Press, 1988.

Gillies, Donald, ed. *Revolutions in Mathematics*. Oxford: Clarendon Press, 1992.

Goodman, Nelson. *Ways of Worldmaking*. Indianapolis: Hackett Publishing Company, 1978.

Gray, John. *Post-liberalism*. New York: Routledge, 1993.

Graves, and Roper, James. "Measuring Measuring Rods". *Philosophy of Science*. 32 (1965), 39-56.

Griffin, James. "Are There Incommensurable Values?". *Philosophy and Public Affairs*, 7 (1977), 39-59.

Griffin, James. *Well-Being*. Oxford: Clarendon Press, 1986.

Hacking, Ian. *Representing and Intervening*. Cambridge, MA: Cambridge University Press, 1983.

Hacking, Ian, ed. *Scientific Revolutions*. Oxford: Oxford University Press, 1981.

Hallden, Soren. *On the Logic of 'Better'*. Lund, Sweden: Gleerup, 1957.

Hintikka, Jaako. "On the Incommensurability of Theories". *Philosophy of Science*, 55 (1988), 25-38.

Hirsch, Eli. *Dividing Reality*. Oxford: Oxford University Press, 1993.

Holyoak, Keith J., and Thagard, Paul. *Mental Leaps: Analogy in Creative Thought*. Cambridge, MA: The MIT Press, 1995.

Hoyningen-Huene, Paul. "Kuhn's Conception of Incommensurability". *Studies in History and Philosophy of Science*. 1990, 481-492.

Hung, Hin-Chung. "Incommensurability and Inconsistency of Languages". *Erkenntnis*, 27 (1987), 323-352.

Kuhn, T.S. *The Structure of Scientific Revolutions*. Chicago: University of Chicago Press, 2nd ed., 1970.

Kuhn, T.S. "Commensurability, comparability, communicability". Asquith, P. and Nickles, T., eds. *PSA 1982, vol. 2*. East Lansing, MI: Philosophy of Science Association, 669-688.

Laudan, Larry. *Science and Relativism: Some Key Controversies in the Philosophy of Science*. Chicago: University of Chicago Press, 1990.

MacIntyre, Alasdair C. *After Virtue: A Study in Moral Theory*. London: Duckworth, 1981.

MacIntyre, Alasdair C. *Whose Justice? Which Rationality?* Notre Dame, Indiana: University of Notre Dame Press, 1988.

Matteo, Anthony. "Grounding the Human Conversation". *The Thomist*, 53 (1989), 235-258.

Margolis, Joseph. *The Truth about Relativism*. Oxford, UK and Cambridge, US: Blackwell, 1991.

Maruyama, M. "Communicable and Incommunicable Realities". *British Journal for the Philosophy of Science*, 10 (1959), 50-54.

Pannier, Russell. "Finnis and the Commensurability of Goods". *The New Scholasticism*. 61 (1987), 440-461.

Phillips, Derek. *Wittgenstein and Scientific Knowledge: A Sociological Perspective*. London: Macmillan, 1977.

Quine, W.V. *Word and Object*. Cambridge: The M.I.T. Press, 1960.

Quine, W.V. *Ontological Relativity and Other Essays*. New York: Columbia University Press, 1969.

Quine, W.V. *Theories and Things*. Cambridge, MA: The Belknap Press of Harvard University Press, 1981.

Rakover, Sam. "Incommensurability: The Scaling of Mind-Body Theories as a Counter Example". *Behaviorism*, 17(2) (1989), 103-118.

Ramberg, Bjorn. *Donald Davidson's Philosophy of Language: An Introduction*. Oxford, UK and Cambridge, US: Blackwell, 1989.

Rashdall, Hastings. *The Theory of Good and Evil*. Oxford: Clarendon Press, 1907.

Raz, Joseph. *The Morality of Freedom*. Oxford: Clarendon Press, 1986.

Reeve, Andrew F. "Incommensurability and basic values". *The Journal of Value Inquiry*, 1997, (31), 545-552.

Sankey, Howard. *The Incommensurability Thesis*. Avebury, Brookfield, 1994.

Scheffler, Israel. *Science and Subjectivity*, 2nd ed. Indianopolis: Hackett Publishing Company, 1982.

Small, Robin. "Incommensurability and Recurrence: From Oresme to Simmel". *Journal of the History of Ideas*, 1991, 121-137.

Stove, D.C. *Popper and After: Four Modern Irrationalists*. Oxford: Pergamon Press, 1982.

Thagard, Paul. *Conceptual Revolutions*. Princeton: Princeton University Press, 1992.

Tiles, Mary. *Bachelard: Science and Objectivity*. Cambridge: Cambridge University Press, 1984.

Weinberg, Steven. "The Revolution That Didn't Happen". *The New York Review of Books*, October 8, 1998, pp. 48-52.

Whorf, Benjamin Lee. See Carroll, John B.

Williams, Bernard. *Moral Luck*. Cambridge: Cambridge University Press, 1981.