PERSPECTIVE RELATIVITY:

a conceptual examination of the applicability of
an articulated notion of "perspective" to such matters as
the problem of meanings

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To my parents, George and Nancy Heppel

ABSTRACT

The aim of this thesis is to articulate and defend a general notion of 'perspectives' and some of the ways that they relate to one another, in order to help to clarify one of the preliminary conceptual problems in cybernetics, namely, the relation between energy propagation (signal) and information propagation (message). The literature on this topic is meagre, although the literature relevant to it is too great to cover comprehensively. The approach closely follows the ideas of Thomas Kuhn and Paul Feyerabend in the philosophy of science.

It is found that the perspective notion has possible uses other than that of signal and message, since the same arguments apply to a wide variety of conceptual and human situations. The concepts considered include: point of view, field space, overall view, three broad categories of perspective difference, compatible and incompatible perspectives, the effect of values and goals, and mutual sensitivity and relevance of perspective spaces.

There are five chapters: the first introduces the perspective approach to the 'problem of meanings' and provides a brief introduction to the other four chapters; the second examines two fragments of the philosophical background; the third offers a relatively informal discussion of perspectives and perspective relativity; the fourth suggests an example of a terminology of perspectives (true to perspective relativity, not the only possible one); and the final chapter summarises some immediate results as well as suggesting some possible specialised applications, including political models, information retrieval and machine intelligence.

CONTENTS

Contents (contd): Page

Contents (contd): Page

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Vivien Heppel

Winnersh 1985

"I know that you believe you
understand what you think I
said, but I'm not sure you
realise that what you heard
is not what I meant." Anon

"The foxes have holes, and
the birds of the air have
nests; but the Son of man
hath not where to lay his
head." Matt 8, 20

CHAPTER ONE : PRELIMINARY REMARKS

Page

Contents:

1.0 Introduction

The problem of meanings, what they are and how they relate to words, to reality and to people, is a traditional exercise for philosophers. When we communicate we use language, pictures and gestures, and we are tempted to believe that if we understood these transmissions well enough, we would thereby understand what communication is. This might have been the case if there were a direct correlation between these representations, at some level of detail, and what they represent. Clearly, however, this is not so; we all know that a sentence (for instance) whose meaning is perfectly clear to one person can mean something quite different to another, and nothing at all to a third. Therefore various philosophical approaches have focussed on such factors as the truth-conditions of a sentence, the utterance in context, the speaker's intention, the recipient's state of knowledge, dispositions to behave, emergent phenomena and so on.

In these days this problem of meanings has become more than a purely philosophical exercise because it has practical ramifications in information systems engineering, and all the various unsolved philosophical approaches seem to have a bearing on this practical situation. Originally designed to make numerical calculations, computers can now in a real sense be regarded as manipulating symbols, as distinct from voltages in their circuitry. In other words, they have higher-level languages than machine code. This progress from automated abacus to symbol manipulator tempts us to look for a similar kind of jump to the level of meanings. If a computer could mean what it says, then we can envisage it carrying an amount of detailed knowledge far beyond the capacity of a human brain, and in such a way that it can recall the appropriate piece of data by 'meaning-matching' rather than relying on matching keywords with no possibility of regard for their meaning.

This notion of levels, though, can be misleading. There are many different kinds of hierarchy, but none of the familiar ones provide a suitable analogy for our problem. It will be suggested, therefore, that it would be more useful to try a different tack.

1.1 The problem

The original task facing this research project was worded as follows:

> "A conceptual investigation aimed at integrating physical principles governing propagation of signals and those of cybernetics which apply to interactions between systems judged continuously by some criterion of success. This entails an extension of the concept of a signal carrying a message. While it is hoped that the applications will be of great generality, the project will at first be limited to some cases of human communication."

The theoretical problem, then, was to find the relation between the *transmission of a signal* and the different aspects of the *message it carries*. The search began for a general theory of communication, which includes the semantic content in a message and the sender's intentions as well as the mathematical theory. If we can understand the relationship between meanings and symbol-strings, said our premise, then perhaps we shall be able to manipulate meanings as easily as we currently handle strings.

Aside from the practical aspect there is the pervasive hope that some light will be shed on certain philosophical problems, in particular that of the possibility or otherwise of a conscious machine. Beside the problem of the 'relation between' signal and message we also have the classic philosophical problems of duality, such as that of the 'relation between' mind and body or, more specifically, mind and brain.

1.1.1 Approaches to a solution

In the course of the project there were some changes of direction, usually because the subject-matter was too large and the effort was concentrated at the wrong end. It appeared that many different but obviously related concepts needed to be integrated: consciousness, goal-directedness, feedback, entropy, messages, coding, values,

significance, stability and so on. There was at that stage a strong desire for a system of categories which is small and manageable but has a place for all these concepts. The various approaches to solving the problem tended to fall into two types: either

a) to create a massive comprehensive framework and aim at fitting the various concepts into it, or

b) to begin with the individual concepts and aim at adding them piecemeal by bridging laws to some existing theoretical structure.

The attempt, for instance, to integrate all the different senses of 'information' began with looking at Shannon and Weaver's mathematical theory of communication. The hope was either to find weaknesses in their theory or alternatively to extend it, in the way Weaver hoped for, to cover meanings and intentions. This strategy is an example of approach b) above, to which we shall return in a moment.

1.1.1.1 Stewart's Ternality

D.J. Stewart's theory of Ternality, as yet unpublished, is an example of the former approach to the kind of integration we are looking for. In that theory, the whole of objective reality consists of three "domains", called respectively primary, secondary and tertiary. Each feature of the world may or may not (Stewart hypothesises that it does) have a component in each of the three domains; such features are called "terns". There is, he says, a genuine sense of discovery in using the theory to look for 'missing' components of terns, in a way analogous to using the Periodic Table to look for new elements.

Work is an example of a tern; primary work is physical labour, secondary work is work with information (discriminable forms), and tertiary work is that which involves value judgments, e.g. design.

The first two domains (which already coexist in physics) are exemplified by the distinction and relation between energy propagation and information propagation. The tertiary domain is the domain of

desires, the domain where it matters which message is sent. One hypothesis is that the relation between the primary and secondary domains is analogous to that between the secondary and tertiary.

Our original problem, put in terms of the theory of ternality, could be expressed thus: to clarify the relations between propagation in the primary domain and that in the secondary domain, and then if any progress has been made, to go on to the relation between the secondary and tertiary domains.

Ternality is difficult; and that is not its only problem. Like all such systems, it does not draw limits around itself, and therefore requires a certain philosophical outlook. In particular, one of its motives is an answer to dualism: the idea is to extend physics into a third domain (the first two being exemplified by mechanics and thermodynamics) in order to account for such phenomena as consciousness. Whether such a philosophy is 'correct' or not is not at issue; it suffices to note that it is controversial (otherwise it would be much easier to understand) and *ipso facto* of limited use, except by its creator and any others who are completely at home with it. It is, in brief, one perspective among others.

But the main problem with ternality, where the problem of signal and message is concerned, is that however well-articulated the theory is the problem still remains, namely that of trying to integrate two (or more) well-defined areas into a single theory. Defining the two sides of a duality in greater and greater detail does nothing to make their mutual integration easier, unless they do in fact overlap or can be embedded in a larger theory. This overlapping or embedding is only one of several kinds of perspective difference, and the others are ignored by this kind of approach.

This notion of perspective difference emerged while puzzling about ternality and about dualities in general. A duality is characterised by the fact that the two sides (signal and message, or mind and brain,

for example) are at once mutually irrelevant and mutually essential: irrelevant in the sense that concepts appropriate to one are inapplicable to the other, and essential in the sense that, in general, one cannot exist without the other. The two sides are in the same place, but not in the same space.

That the one might be a substratum, or underpinning, for the other is a common line of thought throughout Western philosophy, since the dependence seems not to be entirely symmetrical. A signal without a message is quite possible, we just call it noise; whereas a message without some physical propagation to carry it is ultimately mysterious. Similarly, we are comfortable with the notion of an unconscious brain, but disembodied consciousness is another matter. Nevertheless, the notion of substratum, however couched, continues to defy coherent expression.

Under these conditions, the notion that these dualities might be no more (and no less) than cases of the same thing viewed differently does have interesting possibilities. If this notion could be made precise enough, we could then understand what kind of perspective difference we are dealing with and proceed accordingly. If the two spaces are incompatible, it makes no sense to try to integrate them. Understanding precisely in what respects they are incompatible might show us how to manipulate the two spaces most appropriately. This might not only help with problems of duality, but also shed light on the problem of meanings and prevent fruitless searches for nonexistent relations in general.

Before we launch into a theory of perspectives, let us return to an example of the second type of approach to the problem of meanings mentioned in the last section. This example is Nauta (1972). We find there, in passing, a reference to the perspective notion. After that we shall look at some other literature with a view to finding more references to this notion. Not surprisingly, it is frequently touched upon. What is surprising is that it appears never to have been taken quite far enough.

1.1.1.2 Nauta's analysis of the information concept

Nauta's **The Meaning of Information** (Nauta, 1972) does not introduce a new terminology but offers an interdisciplinary study of the "information theme" from the points of view of semiotics and cybernetics. Distinctions are drawn, a framework is set up, and various different versions of the information concept are placed in the framework. It is an excellent book, surprisingly not often cited.

Nauta makes (and elaborates) the point that information (in the sense of being informed, which is the most problematic sense) is relative to the interpreter; thus what is meaningless noise to one person might be highly relevant or useful information to another. The point is also made, though not laboured, that mass/energy (M/E-) and information (i-) are in different perspectives:

> "...*one and the same (open) system can be considered as an M/E-system and as an i-system;* in the latter case the physical state of the system is viewed as an *interior state* in which certain purposeful norms and specific forms of intelligence have been interiorized. **This is just a matter of giving a thing a different name when it is seen from a different point of view.** In cybernetics an abstraction is made of the material and energetic aspects of a system: only the information and form aspects are important. In classic mechanics, on the other hand, special attention is paid to the material and energetic aspects." (Nauta, 1972, p.75) (his italics, my bold type)

Unfortunately Nauta does not develop this line of thinking, but rather seems to regard it as an expression of the obvious (which, indeed, it is) and leaves it there, going on to more detailed and technical discussion of the various distinctions to be drawn: The idea is that the different levels of information processing, called respectively transmissional (Shannon's mathematical theory), syntactic, semantic and pragmatic, are related by embedding; thus syntactics presupposes transmission theory, semantics presupposes syntactics and transmission theory, and pragmatics presupposes the other three.

1.1.2 The perspective notion in recent literature

Nauta's point about points of view is echoed in Sowa (1984), in the last chapter of an overview of knowledge-based systems. An aspect of human thinking that has yet to be adequately modelled is "conceptual relativity":

> "The crucial problem is that the world is a continuum and concepts are discrete. For any specific purpose, a discrete model can form a workable approximation to a continuum, but it is always an approximation that must leave out features that may be essential for other purposes." (Sowa 1984 p.345)

Sowa then quotes the psychologist E.R. Jaensch, who emphasised in 1930 a principle of tolerance - that the only way to approach the whole of reality is to move around among different categorial structures. Earlier still, Kierkegaard (1843, Sowa's reference) pointed out the possibility of mutually incompatible world-views which were nevertheless each quite coherent; in Kierkegaard's example one view was esthetic, the other ethical. But the message is even more ancient: Sowa also points to Lao Tzu's **Tao Te Ching** and the Zen *koans*, which carried, long before Western philosophy began, the theme of the arbitrariness of our conceptual divisions of the world.

One result of this arbitrariness (we notice) is that many if not most arguments (at least about matters of opinion or speculation) are at cross-purposes and have no genuine point at issue. The problem is not: how do I convince him that I am right? but becomes: how do I articulate my side of the discussion (my 'point of view') in such a way that he will understand and thereby agree with me? Each side is trying, not to force the other to agree, but to help the other to 'see things my way'. Some fortunate souls quickly learn that a very good way to communicate is first to listen carefully and try to 'put oneself in their position'. Then it is found often enough that they agreed all along and that the apparent controversy was only the result of a quite harmless difference in perspective.

Not that all perspective differences are harmless; indeed very often a great deal of power is at stake, as in politics or medicine. Our problem, however, is purely technical and therefore need not involve vested interest.

Langefors (1980) looks at the problem of different views from a data-base engineering standpoint. He criticises the literature on data-bases for the way the term 'user view' is generally restricted to mean the user's view of the *data*, as distinct from his view of the *world* as represented by the data. The latter Langefors calls the "infological/ conceptual" view, and his paper points out the importance of consider-ing the infological aspects in data base design:

> "The perspective of information systems theory and infology studies has been that to design the right data and data systems one has to begin with the questions about the information or knowledge that the data are to represent. This means that the information content of the data in the system has to be defined and described in a way that is independent of how the data are handled in the system." (Langefors, 1980, p.17)

Further:

> "We shall see that "user views" are not merely of importance to the way data are to be organised in the store. They are crucial to the possibility for the users to interpret the data. Thus, not only must the data be arranged and ordered to allow efficient processing of the data, according to some view. The data themselves will need to be changed in order to represent the same information to users with a different view." ·(Ibid, p.18)

It is 'information' in this sense which is meant by the term message.

The user view, or "receiving structure" for which the data design has to be made is the general background knowledge of what the various

elements in the data mean - a pre-existing framework which must be known in advance for the user to gain any information. This general background is what we will be calling the 'perspective space'. But:

> "It should be noticed that the insight that the interpretation of a record (for instance, a sentence) depends on the world view S of the "user" does *not* imply that the view S must be explicitly modelled in a schema, for instance. The only thing that it implies is that any record may only convey information to *some* users and, hence, it is important to ensure that the data (the record) are designed with proper attention given to the views, S, of the intended users." (Ibid. p.23)

Langefors' conclusions are of considerable interest, and are quoted here at length. "Community view" refers to a kind of overall view of the data, defined by the database administrator, to which all data must be adapted, and within which all particular user views are assumed to be found, and "external schema" refers to a model, within the system, of a particular user view:

> "The infological (or conceptual) aspects of data and information - as well as of "user views" - that has been discussed in this article imply some fundamental disagreement with the current data base theory aspect...of user views, community view and external schema. Below four aspects are described:
>
> "1) If the data to be used by a particular user have been modified in order to be consistent with some kind of "community view", they may be unintelligible to the users, no matter what data selection and rearrangement is brought about by the use of the external schema. In other words, *it may be impossible to make some data "shareable".*
>
> "2) The user's view of data depends on his view of the world. To such a view one or more sets of data may be adapted. The user may then want to use the same data for the solution of distinct

tasks. *Based on the same view of the data* he may thus want to *process* them in distinct ways and, for that reason, he may want to arrange them differently. This may call for distinct external schemas that, however, have to be based on the same user view. *The interpretation of some data must always be based on the same...user view - the view for which the data have been designed.* But...the application programmer...may view the data according to how they are to be processed - rather than according to what they mean. But the data must always mean the same while distinct inferences are drawn from them in distinct applications.

"3) The idea of *one* community view, declared by *one* conceptual or infological schema has to be replaced by a system of conceptual (or infological) schemas. One or more of these...subschemas... may describe such information as has been possible to establish as "community" information. This cannot be decided by the "data base administrator". It must be determined through learning and negotiation among the relevant users. Some other infological/ conceptual subschemas may describe information that can be shared by distinct user groups but that requires distinct frames-of-reference for distinct user groups. This assumes that the users have "distinct but reconcilable" infological views. The implication here is that distinct users will require *distinct data* to obtain the same information (approximately). This is the case of "shareable information" but non-shareable data. Finally there will be...subschemas declaring user views that are irreconcilable and that, hence, correspond to non-shareable data.

"4) The hypothesis - forwarded above - that there will be user views that are incompatible, implies that the information systems or data bases will contain "islands" of non-shareable data. One consequence is that it will also be pointless to try to cater for formal consistency testing among distinct subsystems. Recognising this fact (if it is a fact) will save a lot of useless analysis, formalisation, and verification work as well as a lot of gathering of testing data. "Total data base integrity" will

be meaningless and impossible, while "island-wise" integrity will still be important - and easier to achieve." (Ibid. pp31-32)

In sum, Langefors is saying that no single community view of data is suitable for all users' views of the world; nevertheless different user views, even incompatible ones, have to be catered for (though not necessarily incorporated in the database in the form of schemas). Instead of one community view, there needs to be a system of distinct views. These must be grouped according to the shareability of the data by negotiation among the relevant users, and not by initial fiat. There is the the additional complication that even within a particular view, the data might need to be arranged differently for different tasks, while still meaning the same. It is, he argues, fruitless to attempt to integrate data designed for incompatible views, and better to concentrate on the less ambitious task of seeing that data for a particular view or set of compatible views is consistent.

We shall encounter several more diverse references to the perspective notion, especially in chapter 2 where the philosophical background of this project will be discussed, and in chapter 5 where some examples of problems and possible indications of solutions are brought together after the perspective concepts have been properly introduced.

1.1.3 The aim of this thesis

As we have seen, this relativity of meanings to perspectives which are frequently incompatible is a well-recognised fact. The aim of this project is therefore not simply to point it out again, but to try to show that it need not always be a problem and can in some contexts be positively useful in solving existing problems.

Relativity is not the same as relativism, which is a philosophical doctrine, perhaps more often used as an accusation than espoused. In the quest for certainty, a philosopher is accused of relativism if his views entail that no-one sees the world more correctly than anyone

else, that truth has no objective standard and may vary from person to person. Usually in practice the relativism is qualified; truth is said to be relative *to something*, so there is ethical, epistemological, cultural and psychological relativism. If the relativity is to something we can all point to and understand, then it is, for us, nothing more sinister than relatedness.

Gregory, in **Mind in Science**, points out in the context of a discussion of the development of physics:

"Einstein, in 1905, took the unprecedented step of accepting inconsistencies between observations and accounts from different reference frames, and saying that although they are inconsistent they are all equally valid. This, it seems, is Einstein's key contribution. Its significance is perhaps still not fully appreciated in philosophical discussions of epistemology; for we still do not seem to be clear about what kinds of inconsistency we can live with, and which must be resolved for acceptable rational accounts of Matter and Mind." (Gregory, 1981, p.531)

We might add: ...and for accounts of signal and message, entropy and meaning, and so on. Perspective relativity might provide a way of clearing some of the ground for resolving this problem of which kinds of inconsistency we can find acceptable, and even useful. However, while it is easy enough to accept relativity as obvious where we are dealing with ordinary, everyday perspective shifts, it does seem that we all suffer from a sort of intellectual vertigo when we notice that it might also allow for perspectives now or forever beyond our ken or when certain conceptual and perceptual habits are challenged. This is not necessarily undesirable, because habits do provide considerable intellectual economy, but it is a point worth remembering because it suggests a difficulty where there need not be one.

The idea of perspective relativity, then, is not a statement which competes for truth value with other statements, neither is it a statement of how things ought to be. Everyday perspective terminology is

widely used; wherever one comes across the terms 'perspective', 'view', 'point of view', 'another angle on it', 'a new standpoint', or any other use of the metaphor of a change of perspective for a new way of looking at anything, the concept is being recognised more or less explicitly. On an even more mundane level, we are constantly changing our perspective on the world as we go about our business; every time a new problem, however minor, commands our attention we shift to those aspects of the world which relate to that problem and ignore all the others for the moment. Sowa points to 'conceptual relativity' as a difficulty and suggests, with the ancient Buddhists and Taoists, that one has to be in the state of perfect enlightenment before one is free of this finitude of particular ways of looking. In this project we aim to show that there is a clear sense in which this relativity can be a positive asset, requiring not spiritual enlightenment but only the spirit of tolerance which Jaensch called for. For a particular purpose, it is not only perfectly feasible but a practical necessity to leave out irrelevant material (as long as it is retained somewhere for use when it is needed). If it were otherwise, we would have to bring the entire extent of our knowledge to every little problem.

Recognising that there are limitations to a concept's relatedness to other concepts also paradoxically allows us to use it with impunity because we know it need not apply beyond the present context.

As an illustration of the significance of what we are suggesting, consider for example the two traditional approaches to (the nature of) truth, namely the correspondence theories and the coherence theories. The bone of contention is this: in virtue of what circumstance are some propositions true and others false? Each theory says something which rings true, if only on reflection. The correspondence approach begins with the perfectly reasonable hunch that if a proposition is to be true, it must express what is the case as a matter of fact in the real world. Difficulties arise when the theorists try to state exactly what the nature of this correspondence consists in, what a 'proposition' and a 'fact' are, and when they have to take into account how far or under what conditions a fact obtains, for example, 'it is

raining', or 'water boils at 100 degrees'. Then, as with all philosophy, there is the problem of fitting everything into a theory which is void of contradictions; in this problem the liar paradox figures large. Ultimately, even Tarski's elegant "semantic conception of truth" leaves correspondence unanalysed. The coherence theorists, aware of this difficulty as it existed since Plato, threw out correspondence altogether, thereby removing the only basis we have of ascertaining the truth of empirical statements, which is to look and see, and instead said that truth of a proposition consists in its fitting into a coherent system with all the other true statements. This might be the case in mathematics, but they hold it for all statements by the traditional weapon of idealism, the doctrine of internal relations. This doctrine states that any relational fact, e.g. that x is next to y, is a fact about the natures of x and y; that nothing would be what it is if its relations to other things were different. Any relations, on this view, are 'internal' to the objects related, and are thus denied ultimate reality themselves. It follows from this that everything enters into the nature of any given thing, so that ultimately only one all-comprehensive entity exists. Since, as a special case, the object of perception is related to mind, this all-embracing entity is mental, so the argument goes.

This problem of truth, or at least the existence of it, interests us on two levels. First, we have an example of two views of something, each of which has difficulty accounting for everything they want it to account for; and secondly, the problem of truth itself has a bearing on the perspective notion.

On the first point, the perspective idea suggests that the points that either side makes do not have to refute the other side, since they deal with quite different aspects of, and hence perspectives on, truth. If a judgment contradicts another judgment, within a particular perspective, then most of us would agree that at least one of them is wrong (coherence); but if two judgments seem to contradict each other and yet are both manifestly true, we would conclude that the logical relation was wrongly applied (correspondence), perhaps owing

to a perspective difference.

On the second point, we would like the perspective notion to include a working hypothesis as to what truth is, which does not lay us open to the charge that we are making the truth of a statement a matter of arbitrary choice. We want to say that truth consists not in the form of words, even in "a sentence in language L", but somehow in the sentence (or other form of representation) in context. Here we can use something similar, in spirit at least, to the doctrine of internal relations - disconnected from idealism. Any statement can be qualified (clarified) to an indefinite degree of precision if a sufficiently perverse devil's advocate is present. For example, snow is white: what, all snow? even when it's dirty or stained? what about the sparkles? it looks pink through my goggles, etc, etc. These are not counterexamples to the whiteness of snow, since they do not deny the original statement; they merely serve to isolate the particular perspective sufficiently to allow the possibility of verification. There is nothing absolute about snow being white unless the statement is specifically excluding all those perspectives on snow. There seems to be no empirical statement to which a similar argument does not apply. A statement of absolute truth must at least state exactly what it means and this entails giving the *entire* relevant context, which could go on indefinitely if the devil's advocate remains unsatisfied.

In conversation such a devil's advocate is usually regarded as a nuisance, deliberately missing the point to appear clever. But provided he is less concerned with definitions, and more with possible alternative meanings or views, he is a very useful tool for thought in separating perspective spaces. Definitions play a minimal part in this project, since they occur within particular, more or less formal perspective spaces and provide truth, in a sense, artificially. Our business is to look at relations between perspectives, and in this realm showing, rather than telling, is likely to be paramount.

If we could find a way to distinguish between different kinds of perspective difference, it would then be possible to determine whether

or not two particular perspectives can be integrated and if not, why not. As a part of this, we should be able to find clear criteria as to what is relevant to a particular problem and what may safely be omitted, in order not to bring the whole world to bear on every problem. With such a framework, we should be able to see the merits of alternative views, without doing violence to the present one.

What we are aiming at, then, is a way of making an everyday notion - namely that we are constantly using different perspectives and not just one comprehensive world-view - precise enough to be useful in mapping meanings, rather than definitions. This has not, to the writer's knowledge, been tried before. Because this is a new treatment of a familiar concept, new terminology will be minimal but there will necessarily be some tightening up of the everyday idiom. Nevertheless, true to the spirit of the last paragraph and remembering the devil's advocate, anything that looks like a definition should be regarded rather as an indication. Rigour is important, but it is relatively easy to diagnose the lack of it; the bigger problem here is style because, in a way that is not esoteric or mysterious, we must needs venture outside the realm of logic to explain what we mean.

1.2 Perspective Relativity

The approach to the general problem of meanings which will be proposed and defended in this dissertation is, as we have seen, more of the nature of a toolkit than a hypothesis, because it is well enough recognised and it does not (hopefully) disagree with anyone's particular view. We hope to work towards a way of classifying, or mapping, different views without modifying them as they stand. We shall call this proto-toolkit Perspective Relativity, because that is exactly what it is. In the text it is often abbreviated to 'PR'.

PR begins with the following:

1) There is always more than one way of looking at something
2) Any empirical statement can be both true and false, depending on how you look at it

3) Incompatible perspectives do not *ipso facto* refute one another's claim to appropriateness
4) Any empirical statement is potentially ambiguous, so communication requires a shared perspective
5) Appropriateness of a perspective depends on the purpose in hand, rather than the perspective itself.

These statements are very ordinary, even platitudes on the commonsense level. In technical philosophical discussion, however, they are generally either ignored, or regarded as trivial, or regarded as excruciatingly naive - especially 1) and 2). There is still lively debate arising from Kuhn's insight (of which more anon) that the progress of science is a history of paradigm shifts rather than a smooth accumulation of one coherent body of knowledge. In the absence of firm criteria for adopting one paradigm rather than another, it is hotly suggested by those who require the One Correct Perspective that Kuhn allows no progress in science at all. The mundane platitude that there is always another way of looking at anything is thought not to apply to those matters which really matter. Suggestion 2) is even worse - it is manifestly absurd; but it is only absurd if applied within a particular system where ambiguity is eliminated artificially. Perspective relativity does not dispute that, it only points out that in another system the truth-value can be different. For example, it is raining; nonsense, it's not raining, it's pouring!, or alternatively, it's not raining, just drizzling! We hear C.E.M. Joad's haunting refrain: "it all depends on what you mean by...". Given these considerations, the syntactic unit that individuates a meaning is not a sentence in natural language, much less a word. Sentences only point to meanings when the perspective is understood; here we find Cherry's (1978) point that communication is essentially sharing.

Suggestions 3) and 5) deal with appropriateness. It is our sense of appropriateness which guides us towards an intended meaning, and if we are to begin to understand how to manipulate meanings we must first understand how appropriateness relates to them. Like morality, it defies coherent explanation; it seems to be a matter of how it feels.

In chapters 3 and 4 an attempt will be made to develop these lines of thinking and work towards clearing some of the ground for any formal theoretical treatment of the problem of meanings which might seem appropriate to a particular area. Such a formal treatment will not be attempted here; this is an exploratory study of possibilities, with no specific application in mind. However, some possible applications might be indicated.

1.2.1 Structure of the thesis

The rest of this chapter will consist of a fairly extended introduction to the remaining chapters, in order to provide an overall view of the way the thesis is laid out. Since a wide range of apparently disparate areas are clearly relevant to our topic, it is desirable at this early stage to indicate briefly those areas that we shall be looking at, and show how they fit into the overall theme.

1.2.2 Philosophical background

PR is not something that is either true or untrue - in that sense, it is not a doctrine but a way of looking at ways of looking. PR's very neutrality will, however, call for further philosophical discussion, which will be the substance of chapter 2. Perspective relativity must be shown to be philosophically acceptable, in particular in its relation to relativism and realism. At the same time, it must be shown to be genuinely useful - that it is not, by its harmlessness, thereby totally vacuous. Finally, we should consider why, if it is all of these things, has it not been developed before?

Chapter 2 looks at some related approaches in the history of philosophy and the philosophy of science. In the first section we shall look at the movement in American philosophy in the 1920's and 30's of direct realism which Murphy called "objective relativism" and which McGilvary developed under the heading "perspective realism". Although it is usually taken to imply a 'subjectivist' metaphysics, relativism was there argued to be consistent with the notion of an objective

reality. The main objective of the first part of Chapter 2 is therefore to try to find out where this movement failed and whether we can salvage anything useful from it, given that our purpose is different from theirs.

In the second section of Chapter 2 we shall look at the controversy surrounding 'the new image of science' as it has developed from Kuhn's **The Structure of Scientific Revolutions** (Kuhn, 1962), which considers the implications of incompatible perspectives. The concept of a paradigm's being inextricable from an observation has been taken to lead to the thesis that progress in science is impossible, and that we know no more about the world than Aristotle did. Section 2.2 and its subsidiaries argue that this fear is unfounded and that multiple perspectives, especially mutually incompatible ones, provide a more fruitful approach to understanding the world than concentration on a single one can.

1.2.2.1 Murphy and McGilvary

The principal champion of "objective relativism", and the one who gave the movement that name, was A.E. Murphy. In particular, the movement was an attempt to account for the fact, puzzling to some philosophers of perception, that the same thing looks different from different points of view, and yet it is still the same thing. The difficulty is to avoid dualism and indirect realism, both of which place something in between the perceiver and the object. Murphy pointed to a pervasive assumption, namely that the 'relative' is incompatible with objectivity, and suggested that the assumption could legitimately be put aside. He found Dewey and Whitehead more intelligible when read this way, and especially cited Whitehead's notion of "the fallacy of misplaced concreteness". If events, rather than objects, are regarded as more fundamentally concrete, then one result is that the relativity so deplored by those who crave objectivity is

> "...here no other than the fact of relatedness" (Murphy 1927 p58)

and thereby loses its sting.

While Murphy had attempted to clear the ground for a theory of objective relativism, it was E.B. McGilvary who made the most complete attempt at such a theory, which he called "perspective realism":

> "...perhaps perspective realism...can be provisionally defined as a philosophical theory that regards every experience, including the experience of a philosophical theory, as the *real objective world* appearing in the perspective of an experiencing organism." (McGilvary, 1956 p6)

McGilvary is principally concerned to analyse consciousness as the converse of appearing, and he thereby blocks the suggestion that we can judge whether or not something is really the way it seems. This makes illusion and hallucination, the other main problem for direct realism, difficult for McGilvary to account for. His theory did not allow for the possibility of other analyses of consciousness in other perspectives, and that one of these might account for the choice of the particular perspective space in which the illusion is viewed. In any case we, who have no vested interest in a particular view of consciousness, can say that any non-veridical perception arises from the wrong choice of perspective space. We know a lot about illusions (thanks largely to Gregory), and many of them can be exposed by comparison with other perspectives. Hallucinations are more extreme, and arise within the brain, but still a similar argument may apply; even the sufferer can shift perspective to try to verify the apparition, and others can look for its cause in the nervous system, at least in principle. Gregory argues:

> "Any sense organ can give false information: pressure on the eye makes us see light in darkness; electrical stimulation of any sensory endings will produce the experience normally given by that sense. Similarly, if movement is represented in neural pathways, *we should expect to experience illusions of movement if these pathways are activated or disturbed.*" (Gregory, 1977 p103)

The other principal objection to McGilvary is his result that all perspectives are equally valid, something which at first sight is manifestly absurd. In our view, however, it is only absurd if it is a statement of a philosophical position, in which case it defeats itself by allowing all the positions it explicitly denies. Since McGilvary was mostly concerned with a problem in epistemology with a standard formulation, he did not extend the theory to accommodate incompatible perspectives; indeed, he was trying to fit all perspectives into the same space, by adding dimensions (e.g. time, in the case of the distant star) if necessary. If his theory had, instead, allowed for incompatible but equally coherent perspectives on everything, and were viewed as a strategy or policy rather than an all-embracing statement of philosophical truth, its original promise might have been restored. As it was, Murphy later had a change of heart and became one of its most disparaging critics.

1.2.2.2 Kuhn's paradigms

Since the demise during the nineteenth century of the speculative system-building mode of philosophy in favour of the new "scientific philosophy", of which objective relativism was a part, there inevitably emerged a new orthodoxy - albeit of a different kind. Reichenbach tells us that:

> "Ever since the death of Kant in 1804 science has gone through a development, gradual at first and rapidly increasing in tempo, in which it abandoned all absolute truths and preconceived ideas." (Reichenbach, 1951, p.125)

This new orthodoxy was based on the assumption - revolutionary at the time - that all preconceived ideas could be laid to one side and a scientific observation could be made with a pure, although specially trained, mind. No theory was necessary in viewing Nature, it was just a matter of asking questions and setting up experiments which would show the answers. But this early confidence in the new empiricism was

soon tempered, especially by Hume's articulate scepticism about causal links and about the inference from the observed to the unobserved - the problem of induction. Reichenbach warns of the danger that the ancient quest for certainty is a tough habit to break.

> "...even if the problems are seen, the solutions might still be sought along those paths which an age-old tradition has glorified and which the student of our universities, in the formative years of his scientific training, has usually not learned to criticize." (Ibid., p.311)

Scientists themselves, naturally, have always had very little time for the pronouncements of philosophers on how they should go about their work. They have continued to design experiments and formulate theories with results that are undisputedly successful. By the middle of this century science had some history, and Thomas Kuhn took the opportunity to look back at the development of scientific theories; he found what appeared to be a pattern. The pattern was a succession of scientific revolutions, or paradigm shifts, punctuating periods of data-collection and theory-refinement according to the current paradigm. A paradigm is not just a theory but:

> "...theory, methods and standards together, usually in an inextricable mixture" (Kuhn, 1962 p.109)

and a paradigm shift, being such a wholesale change of view, renders all the results of the old one obsolete.

This gave the quest for certainty a blow that no-one could ignore, for it is now not only the unobserved that we cannot know for certain, but the observed results as well, since they are so heavily dependent on the theory which prompted them. It is inferred, though not by Kuhn, that science has not progressed at all, but is on an inescapable treadmill. Therefore, true to Reichenbach's warning, Kuhn's ideas are still controversial although the spirit of "the new image of science" is now common currency. Paradoxically, one critic of Kuhn claims that

Kuhn and his followers are themselves victims of the profound habit of "deductivism" - that nothing but certainty will do.

The arguments relating to Kuhn's insight also apply to perspective relativity in a similar way, so they call for careful examination in chapter 2. Kuhn himself pointed out that the notion of a paradigm was his key to reading Aristotle, the point being that it is precisely the recognition of a multiplicity of paradigms which makes other views available to us. Obsolete, perhaps, in the current view, the superseded results can come to life again if we will only step into their perspective space for a little while.

1.2.3 The intuitive idiom

The main purpose of chapter 3 is to explore the everyday idiom of perspectives, to see how far it has been, and can be, taken as it stands, and to bring together considerations necessary for a more formal treatment, such as, what we would like it to do for us and what are the pitfalls to avoid?

In the course of this discussion, we find ourselves distinguishing three aspects of a perspective which could be of use to us, namely, the theoretical (representation), practical and 'being there' aspects (see chapter 3 section 3.3). This is, of course, not an attempt at an exhaustive list; in this context it would make no sense to ask for one. There will always be more aspects to something than anyone can name, and the aspects of a perspective are no exception. (Perhaps there is a flavour here of Spinoza's notion that of all the infinite aspects of God, thought and extension are the only two that are manifest to us.) (Spinoza, 1677, or see the Enc. Phil. 1967 'Spinoza'.)

Usually it is the Theory aspect, where the perspective is expressed by such means as language, diagrams and gesture, that tends to be considered primary. Thus Searle tells us:

"On my view, the world divides the way we divide it, and our main

> way of dividing things up is in language. Our concept of reality is a matter of our linguistic categories." (Searle, in Magee (ed), 1978)

Whorf (1956) also stresses the importance of a particular language's categories in a view of the world. Because of this, some foreign languages are more difficult to learn than others. Nevertheless, they can be learned. To say that language precedes and determines the way of looking is a little like saying the chicken came before the egg. Learning and teaching a language involves showing as well as telling. The three aspects are in many ways independent of one another, but in other respects they are obviously intimately related, and do constrain one another in certain specific ways.

These three aspects of a particular perspective cannot by themselves lead us to a shift to other perspective spaces, and so the problem of appropriateness and relevance of a perspective to a situation and a problem, or purpose, is central. The present situation on the one hand, and the purpose on the other, somehow determine whether a particular perspective is appropriate or not. Human beings generally switch without thinking about it, where the situation is familiar, but on occasions where the new perspective is completely new there is a quality of sudden insight, or revolution. The only difference, it seems, between these two types of shift is that in the latter the new perspective is seen for the first time. If it is useful, it will soon become as familiar as any other way of looking.

We have already noticed that the meaning of a sentence is not individuated by the sentence itself. Even if all the concepts are clearly defined, the sentence can still remain ambiguous to a perverse devil's advocate. On the other hand, discussion of the speaker's intentions towards the recipient tends to bring in many psychological factors which seem extraneous. It is considered here that the meaning of a sentence, or any other form of representation of a fragment of the world, can in principle be individuated by indicating the particular perspective space to which the representation refers and (if relevant)

the point of view in the space. That is, any ambiguity in a sentence which is otherwise well-formed and clear, is due to ambiguity in the perspective to which it refers. Only a recipient who already has experience in that perspective space will be able to find the meaning in it.

This process of settling on the perspective space that the speaker has in mind - something we do all the time without thinking about it - is probably the most difficult aspect of communication to understand well enough to simulate in AI systems. It would have to be tackled by some kind of search, a process closer to the devil's advocate routine than the sympathetic listener. The search, however, is not for concepts (or strings of symbols which stand for concepts), but for a space in which the concepts make sense.

The trigger for an appropriateness judgment is generally some problem or purpose, the statement of which gives clues to the space. A solution to the problem might present itself, but then turn out to be unacceptable in other perspectives, as in the case of the cat and the fleas. A sure way to rid the cat of fleas is to incinerate the cat. The end (result) does not justify the means unless it is acceptable in all relevant spaces. An appropriateness judgment for a particular purpose therefore has to take into account purposes and interests in all the other spaces which are affected. An exhaustive search among all relevant perspectives is impossible for a complex problem, because there are so many of them. The difference between this combinatorial explosion and the string-matching one, however, is that some match can be created right away, and the perspective can shift to why, if at all, it is unsatisfactory.

1.3.1 Example: the problem of freewill

Let us by way of example take a very cursory glance at the philosophical problem of freewill. As a first step, obviously it is necessary to analyse the concept of freedom. What perspective relativity can point out is that there is no reason to imagine that one and only one of the many possible analyses is the correct one.

For example, let us assume for the sake of argument that freedom is either something we all (potentially) have all of the time or something none of us have any of the time. In the first camp there are the legal perspective, dualism, most religious perspectives and probably most practical, everyday perspectives. There is the distinction between liberty and licence, and the concepts of responsibility, guilt, praise and heroism. In the second camp we have the physical and life sciences, behaviouristic psychology, materialistic perspectives and aspects of some of the more sophisticated paradoxical religious perspectives, such as the notion that in perfect freedom there is no choice.

We pick our perspective according to our present situation, and either the perspective allows for free choice or it does not. Anyone who wishes to say, independently of any particular situation, that there is no freewill or that there is freewill, is saying that a whole range of perspectives are either incoherent or, at best, inappropriate in *all* situations. His task is then to point out the incoherence, perhaps to separate the incompatible spaces which comprise the incoherent one, and/or to show why the view is inappropriate even if it is coherent.

Thus where before we had a menu, consisting of a world with freewill and a world without any freewill, only one of which was valid, we now have a different kind of menu. The various items are all available as long as we do not conflate two incompatible perspectives. We don't lose anything by seeing that two spaces might be incompatible, because incompatibility does not necessarily imply that one of the views must be incoherent.

1.2.4 Perspective concepts

In Chapter 4 an attempt is made to bring these notions together in a more precise way. A definitive theory is not the aim, or outcome, of this work, because different applications will call for different treatments and no theory of PR will be the only correct one. It is

hoped instead that some of the ground will be cleared so that formal treatments, if appropriate, can be more readily found. Concepts such as point of view, field space, view and overall view are discussed, also different categories of perspective difference, mutual sensitivity and relevance, perspective shifts and jumps, and purpose and appropriateness are considered. We find that a great deal can be done on the conceptual level without recourse to complex formulations. The separation of three distinct categories of perspective difference is found to be particularly useful in such deliberations.

1.2.5 Results

Our results are of two kinds: first, some of the different ways in which perspective concepts interact are indicated, and secondly some of the implications of these interactions are discovered. Some possible technical applications emerge in the course of the discussion, as well as an indication of a solution to the original problem, that of the relation between a message and its carrying signal.

On occasions in the discussion we refer to "the user" and "the system". This is because we are envisaging a machine which can use perspective relativity and a user who requires information from it. The arguments and strategies do, however, apply equally well to interactions between two people, perhaps an expert and a layman, or a librarian and a library user, or anyone asking advice, professional or otherwise, from someone who has knowledge and/or tools which he lacks. It even applies to a person's own discussions with himself. Since no machine yet has PR, the user and the system referred to are both best thought of as people; the user asks a question, the system answers it with the help of PR.

The results, summarised in the last chapter, might not be surprising but it is hoped that they have been expressed in a more useful way here than they have in the past.

CHAPTER TWO : PHILOSOPHICAL BACKGROUND

Contents: Page

2.0 Introduction

Once we look out for perspective terminology and notice how often it occurs, it seems to be very ordinary and unproblematic. We all take it for granted in the same way that we take parallax for granted. Relativism - as distinct from relativity - has, by contrast, evoked a whole range of vehement reactions, from relief to unconcealed hatred (as in Popper, for instance).

In Section 2.2 and its subsections, we look at recent philosophy of science, where that debate still goes on. In particular we shall examine the notion put forward by Kuhn and others that scientific observation is paradigm-dependent. Since 'scientific truth' must depend on scientific observation, it seems to follow that if there is any such thing as the truth it will be forever beyond our ken even if our way of seeing is *the* ultimate, appropriate one, because we have no way of knowing that it is. Since progress is thought to be a process of closer and closer approximation to the truth, the very assumption that there has been any progress in science at all is called into (rhetorical) question. This seems to be close to the core of objections to anything that smacks of relativism. Such objections seem to be more passionate than rational because a great deal is assumed to be at stake. This is not to say that opponents of relativism do not offer decent argument, but only that perhaps some of them could look again at what they stand to lose.

The problem of the truth of empirical statements, i.e. the problem of knowledge, has so many different facets which are interdependent. There are the problems of truth and meaning, some of which are already mentioned in Chapter 1. If these were all solved by a coherent (and necessarily open-ended) theory, there is still the problem of how we ask Nature for arbitration, and here we need to explore the nature and possibility of perception, not neglecting completely the phenomenon of consciousness. Physiological mechanisms (which themselves involve theories) must be taken into account, as must their frequent failure. Metaphysical puzzles, where they arise, must be either solved or shown to be harmless for the present purpose.

In this connection we find the literature on "sense-data" and "appearing". The fragment that we shall examine in the next section, before we discuss modern philosophy of science, was written without the benefit of Kuhn's insight. It concerns the revolt against idealism in America in the early decades of this century, in particular the movement Murphy called "objective relativism" (which he since discarded) and McGilvary's "perspective realism".

2.1 Relativity, relativism and realism

Realism, in modern philosophy, is the doctrine that material objects exist independently of our sense-experience. It is thus opposed to idealism, which holds that nothing exists outside our consciousness of it, and that the universe is therefore essentially mental. It seems incredible to us that idealism was ever espoused, but it was dominant until the beginning of the twentieth century and the rise of science.

There were two broad styles of attempt to escape from idealism and the doctrine of internal relations. These were firstly the various forms of 'direct' realism, the general view that to perceive an object is to be directly aware of the object itself, and secondly the various forms of 'indirect' or 'dualist' realism, the view that what we see is primarily representations of the objects in the world (e.g. sensa).

Chisholm (1950) examines the relative merits of use and avoidance of "sense-datum terminology", the alternative being the "language of appearing". The concept of sense-data, he says, arose from the puzzle that in perceiving an object, something can vary (e.g. in size or shape) according to the prevalent conditions where the object itself is not thought to change. This something is a sense-datum, a sort of intermediary between the object and the percipient. Chisholm examines the contention that the puzzles which arise from this terminology, e.g. that of the status of sense-data, can be escaped simply by using a different terminology which has the notion of the object "appearing" to the percipient directly, and differently under different conditions.

Chisholm's conclusion is that the language of sense-data is indeed unnecessary for expressing what we want to say about perception, but that the metaphysical puzzles which arise are at least as problematic as those just escaped, and are very similar to those encountered by classical dualism.

The main bugbears for direct realism and the theory of appearing - the view that we perceive objects directly, rather than mental representations of them - are the problem of accounting for illusion and hallucination, and the problem of accounting for the different appearances of the same object, so that a penny looks round sometimes and elliptical at other times, its colour depends on the lighting conditions and so on. It is the first of these difficulties, primarily, which has led to disenchantment with direct realism and given rise to the dualistic forms. We shall examine some of the theories which tried to reply to the second difficulty, in particular those of Murphy and McGilvary, and then look at their failure to deal with the problem of illusion.

2.1.1 A.E. Murphy

The general thesis of these theories is that an object's intrinsic shape, colour and so on are always perceived relative to some point of view. "Objective relativism" was a term coined by Murphy to refer to this movement, in particular as he found it in Dewey and Whitehead. Even though he later discarded the "old faith", his 1927 paper (Murphy, 1927) is his best-known work.

He begins by pointing out a pervasive presupposition, namely, that something cannot be both objective and ultimately relative.

> "No better illustration could be found than the very familiar struggle between monistic and dualistic realists. The question to be determined is that of the objectivity and ultimacy of immediately experienced data. The dualist says that they are *not* objective, and his proof rests throughout upon the fact of their

> relativity. The monist insists that they are objective and hence must introduce 'external' relations and try to show that they are not ultimately and intrinsically relative." (Murphy, 1927 pp.50/51)

He then goes on to say that although Dewey and Whitehead do not develop the point sufficiently, each of them can only be understood if that presupposition is put aside. So it must be established that it can coherently be put aside.

> "The foundation of the whole affair is an inversion in the relation of objects and events. The distinction itself is not new, but the use made of it is revolutionary. ...
>
> "The traditional theory has treated objects as primary, as substantives, and events as characters of objects. ... The objective reality is such as to be complete in itself and the fact of happening, of occurrence in a given situation or context, is extrinsic to it. In the sense in which the terms are here used, it was an object or set of objects, never an event. The theory we are considering transposes this relationship. For it the event is substantive and objects are characters of events. Thus relatedness, in all its complexity and interconnections, is made basic for the objective world." (Ibid., p.53)

The consequences, as Murphy lists them, are these: first, the transient aspect of events means that time makes a difference to them which it cannot, by definition, make to objects. Time is thus 'promoted' in physical speculations. Secondly, existence is no longer mysterious; where existence is not essential to the nature of objects when they are taken as fundamental, the occurrence of events is precisely what gives them their uniqueness.

> "Events depend upon relations, but they are not relations, and this fact is essential." (Ibid., p.56)

Thirdly, the concrete reality of an event is simply the union of the other two aspects:

> "An object is always just itself and nothing else. An event is always more and less than itself in this sense; less in so far as it is incomplete and owes its being to the situation of which it is a part, more because it exists, it plays its part in what goes on, and existence is no part of an object 'in itself.' This mixture of finality and dependence, of immediacy and transcendence, is the most pervasive fact about the world as pictured by objective relativism." (Ibid., p.57)

It is this metaphysical primacy of events, as distinct from objects in space, which Murphy regards as essential. At once relativity becomes easy to handle:

> "The fact of relativity is here no other than the fact of relatedness" (Murphy 1927 p.58)

It is not simply that events are opposed to objects and the choice of the former is more fruitful; this would be to make the same mistake of "bifurcation" as those theories which tried to do the opposite. It is rather that, taking events as existent in their own right, objects immediately find a place in the scheme:

> "An object is a character, a universal, a meaning, and the function of such objects is altogether central." (Ibid.,p.58)

In other words, objects characterise events; they function as adjectives and thereby provide the nature of what goes on:

> "Where an event is existent in its own right but owes its nature to its relations, an object has its own intrinsic nature but its existence is extrinsic; it may or may not occur. Both Whitehead and Dewey claim that the main errors of traditional philosophy have arisen from an attempt to ignore this fact. Whitehead has

> coined the very happy term 'misplaced concreteness' for this mistake." (Ibid., p.59)

Some more should be said about Whitehead's notion of misplaced concreteness. In **Science and the Modern World** he traces the prevalent habits of thought as they change to accommodate the beginning of the scientific temperament. There were two different trains: on the one hand, the use of rationality to discover general principles, and on the other hand, the use of induction and minute attention to detail to find the order in nature which we instinctively believe is there. The latter was a revolt against the former, and the resulting cross-purposes led to the breaking away of science from philosophy: the scientists had their "naive faith" and did not feel the need to justify it.

> "There persists...the fixed scientific cosmology which presupposes the ultimate fact of an irreducible brute matter, or material, spread throughout space in a flux of configurations. In itself such a material is senseless, valueless, purposeless. It just does what it does do, following a fixed routine imposed by external relations which do not spring from the nature of its being. It is this assumption that I call 'scientific materialism'." (Whitehead 1926 p.30)

The problem of the justification of induction and Hume's criticism of the possibility of science went blandly unheeded. This scientific materialism reduces the whole of nature to "merely matter in motion", and leaves no room for what came to be called "secondary qualities" such as colour, taste and smell. The result is that the qualities which make life interesting are all products of the human mind; Nature itself is dull and meaningless.

> "The enormous success of the scientific abstractions, yielding on the one hand matter with its simple location in space and time, on the other hand mind, perceiving, suffering, reasoning, but not interfering, has foisted on to philosophy the task of accepting

them as the most concrete rendering of fact." (Ibid.,p.73)

Hence philosophy has found itself juggling with these *abstractions*, mind and matter-in-motion, as if they were concrete; it seems trapped in an oscillation among dualism and two forms of monism. And all because the abstract has been mistaken for the concrete. Concreteness belongs not to objects in space whose nature, but not existence, is intrinsic to their being but, so the argument goes, to events only. The nature of an event depends entirely on external relations but its *occurrence* is intrinsic to its being. (For ourselves, looking at this argument, it seems that we are being taught a more precise meaning of the word 'concrete', since we might have been forgiven for regarding the concreteness of something as consisting precisely in its intrinsic *nature* and not, as we are now told, only in its intrinsic *existence*, for which objects in space do not qualify. Perhaps this is precisely the bad habit to which Whitehead refers and if so, it is not surprising that it is still not easily broken.)

To return to Murphy's article: taken on its own terms, he says, this new theory is a model of coherence and has only been rejected because of the old inability to allow what exists to be ultimately relative. Once the old presupposition is denied, the new theory can be understood on its own terms and immediately looks promising.

Murphy himself did not take the matter further in that article, but just claimed to have cleared the ground for further work to be done. Later, however, he changed his mind and published a critique of the objective relativism movement. Since by all accounts the most carefully worked out theory was that by McGilvary, we shall turn to him before returning to Murphy's change of outlook which criticises the theory in detail.

2.1.2 E.B. McGilvary

McGilvary attempted (with some help from a Hegelian background) to combine the truth in both sides of the monism-dualism debate, and the

result was his "perspective realism". His 1939 Carus lectures are reprinted, after considerable revision, in McGilvary (1956). His introductory remarks, much condensed here, seem to promise something very like our PR:

> "Every philosophy is the universe as it appears in the perspective of a philosopher. ... The perspective realist makes no claim that he can speak for the universe as it is for *itself*. ... He sees in part, he knows in part, he prophesies in part; and that which is perfect never comes, except as a goal that lies afar off before him. ... Absolutes, whether logical or ontological, he has none ...
>
> "In one sense it is nothing new. It is almost as old as philosophy itself. We are all familiar with the dictum of Protagoras that "man is the measure of all things: of the things that are, that they are; of the things that are not, that they are not."
> ...in the philosophical tradition that goes back at least as far as Plato the acceptance of Protagoras's "Man the Measure" has been regarded as the great philosophical betrayal. ... Without some certainty, without something that is known as absolutely true, it was dogmatically assumed that there could be no advance to knowledge of anything else. There must be "first principles" which are "self-evident" and therefore unquestionable, and they remain such, world without end. ... Through the centuries this position found powerful support in the geometry then current ... What had not been questioned was taken as unquestionable. ... it is not surprising that philosophy, too, in her earlier days, while aspiring to be queen of the sciences, should have had equally indubitable first principles, the very first of the first. ...
>
> "But...the nineteenth century brought with it a radical change in the foundations of mathematics. There are in mathematics no longer any "axioms" of universal sweep. They have been replaced by "postulates". Instead of starting from self-evident premises

geometry now starts from "assumptions", and many different assumptions are eligible. ... Philosophers are beginning to follow again the lead of science. The mood of absolutism is evaporating, leaving relativism as a deposit in many quarters. And relativism works from postulates and not from principles enjoying the sanction of self-evidence. This relativism differs from that attacked by the earlier tradition of absolutism. It is not a relativism which results in general scepticism. What scepticism there is is one of caution and not of despair. ...

"But what is perspective realism? ...so far as this can be done, perhaps perspective realism...can be provisionally defined as a philosophical theory that regards every experience, including the experience of a philosophical theory, as the *real objective world* appearing in the perspective of an experiencing organism.

"We have all perhaps had the experience of wondering what a man - and not necessarily a philosopher - is talking about. His words don't make sense. But hoping that we shall arrive at an understanding, we continue to listen. After a longer or shorter time it all "clicks". ... A new philosophy is like a new suit of clothes; it must be tried on before one can learn whether it fits, and it must be worn in order to find out whether it wears well.

"Perspective realism offers itself for this trying on and this wearing; but ... it does not offer itself as something brand-new. Very few recent philosophers have neglected the use of perspectives in their make-up. ... Thus perspective realism is not introducing a new concept into philosophical discussion. All that it claims to do is to make it central in the array of philosophical concepts ... it is different from that current in many present-day philosophers. It restores to the word "perspective" the meaning it has in popular thought."
(McGilvary, 1956, pp1-8)

Unfortunately, the promise is incompletely fulfilled, not because of a flaw in McGilvary's argument, but because his main emphasis is on an elucidation of the nature of consciousness; perspective relatedness is a useful background for his thesis that consciousness is the organism perceiving.

His own postulates, stated and discussed throughout the lectures, total nine. The first three postulates are:

1) "In our sense-experience there is presented to us in part the real world in which we all in common live and move and have our being";
2) "Every particular in the world is a member of a context of particulars and is what it is only because of its context; and every character any member has it has only by virtue of its relations to other members of that context."
3) "In the world of nature any 'thing' at any time is, and is nothing but, the totality of the relational characters, experienced or not experienced, that the 'thing' has at that time in whatever relations it has at the time to other 'things'.(Ibid.)

This looks incredibly clumsy, like a tortured attempt to negotiate a path between the theory of internal relations and the theory of external relations, with an acute awareness of the difficulties of each. Thus 'thing' must go in inverted commas, and the theory of internal relations must be confined to 'particulars'. McGilvary is particularly concerned to elucidate consciousness as a (nondynamic and "epiphysical") relation between an organism and a thing perceived:

"What differentiates more than anything else my perspective realism is the view of consciousness as an *epiphysical* relation whose occurrence depends upon nerve activity. Just as in sense and sense perception and memory physical objects and events appear to us in perspective, so do they appear to us also in intellectual perspectives and moral perspectives and esthetic perspectives. In none of these cases does the physical object

appear to us as it is by itself, for...there are no things by themselves; they are all things in relation and the characters... vary...according to the different relations of which they are terms. ... Now a perspectivist, to be thoroughgoing, should recognize that his perspectivism is itself relative, not absolute." (McGilvary 1956 p.193-4)

This relativity, which allows even opposing views to be correct when seen in their own perspective, is one of Murphy's later targets. But McGilvary points out that it all depends on not confusing one perspective with another, and this is the answer that PR would like to give. We shall examine Murphy's argument in the next section.

On the subject of the now extinct star we nevertheless see in the sky, McGilvary suggests that there are temporal perspectives as well as spatial, and that the time interval is foreshortened to zero. This seems as good an answer as any. On the subject of the spot in the bottom of a cup of water (a case of 'things are not always what they seem'), McGilvary's reply is that the position of the spot (the direction of it) is correctly seen in that particular perspective relation whether there is water in the cup or not. This is more difficult, and Murphy pours scorn on it.

McGilvary wanted to make "consciousness" the converse of "appearing" and it was his desire to explain consciousness in a certain way which probably most inhibited his perspectivism. Perspective relativity, as we shall see, does not depend on a certain view of mind, even when we consider illusions and hallucinations (which it seems McGilvary does not, except to cite examples of cortical stimulation to lend weight to his theory of consciousness).

2.1.3 Murphy's about-turn

Later even Murphy changed his mind and in an extract from a work written in 1940, reprinted as chapter 6 of Murphy (1963), he offers an "antidote" to the earlier view. Since this later article was not

specifically written for that purpose, it gives the impression of mentioning objective relativism only in passing and is more a discourse on perception. The inversion of the object/event relationship is only touched upon as an "important contribution" to the epistemological debate.

That paper is, for our purposes, a real treasure because it points to all the standard difficulties which we wish to avoid. It is here that we find a discussion of the problems associated with the relativity to context of the truth of statements - our problem of the different colours of snow.

The original problem that objective relativism tried to solve was to avoid dualistic realism, the dichotomy between appearance and reality, and the solution was to point out that there is no reason why reality should not be relative to a viewpoint and that what is perceived is really the object, if only in part. For statements of this doctrine, Murphy quotes from Cohen (1931) p.166:

> "...two statements which, taken abstractly, are contradictory may both be true of concrete existence provided that they can be assigned to separate domains or aspects. A plurality of aspects is an essential trait of things in existence. Determinate existence thus continues free from self-contradiction because there is a distinction between the domains in which these opposing statements are each separately true." (in Murphy 1963 p.68)

and from Lewis (1929) p.185:

> "...there are certain properties of the object, an independent reality, which can only be described in terms of some observer, or some frame of motion. But specify this relationship and the true description is thereby fixed. What is it that determines this? It cannot be the relative motion already specified. It is fixed by the objective real character of the thing." (in Murphy 1963 p.69)

This, coupled with Whitehead's new outlook on the concreteness of events, looked promising. The only detailed theory to be worked out from this point is McGilvary's. Murphy applies some counterexamples to McGilvary's argument: that of the distant star which, though seen now, might no longer even exist; that of the railway lines which, though they appear to converge, must be parallel if they are to function; and that of the colour of an apple which is different in different lighting conditions. The question that is put is: is what is perceived really what is out there?, and the discussion seems to concern the sense of 'really'. Murphy points out that

> "...we do actually make a distinction, within the field of perceptual observation, between what things look to be and what in fact they are." (Murphy 1940 p.72)

He goes on to say:

> "When McGilvary says that an apple really is whatever in any perspective it is found to be, he may not actually be rejecting this distinction, but simply using the term 'really' in a different sense. In that case the railroad tracks are really convergent in McGilvary's sense, and also *not* 'really' so in the ordinary perceptual usage." (loc.cit)

The argument, then, is that the theory itself is ambiguous, and therefore lends itself at once either to attack or to speculative elaboration. On the subject of the spot in the cup which appears in a different place if the cup contains water, Murphy says:

> "Perhaps the answer is that "correctness" and "incorrectness" are terms properly applied not to sensations as physically produced but to the estimates we make, given such sensations, of the real properties of things observed. But this cannot be McGilvary's answer, for it would involve a relation between "subject" and "object" other than that of "consciousness" or "appearing", on which he has staked his case for perspectivism. What he does

> instead is to continue his effort to get the appearance as sensed into the physical world as a "perspective" character of the objects that constitute the world." (Ibid. p88)

It seems very difficult to escape from dualism, and this is where McGilvary falls down. As R.J. Hirst writes:

> "Such perspective-realist statements as "The table is round from here" sound forced, for the natural word to use is "looks," not "is," and it is possible to express this kind of direct realism in terms of looking or appearing. Physical objects simply are such that they appear different from different positions, and we see them as they appear from a viewpoint or in certain conditions. Thus, we may see the round table looking elliptical from here, but even so it is still the table that we see. Thus far the theory is trite and does little more than state the situation in a way which dualists could accept and then claim to analyze. To be distinctive, it must, as its essential characteristic, separate directness and incorrigibility. ...
>
> "...(Some might object that the theory cannot admit that perceiving is ever erroneous. Perspective realism treats all properties as relative and all perspectives as equal - the table is round from here, elliptical from there, but not round in itself; similarly all appearances should be treated as equally valid. Nevertheless, it seems more plausible to treat some appearances as privileged; in some conditions we see the real shape, the round object appearing as it is - that is, round. It may be considered a weakness of the perspective theory that it does not take into account the fact that objects do seem to have real (measured) shapes and volumes absolutely, not relative to a viewpoint.)" (Enc. Phil. 'Realism', p.78)

It seems to be assumed that the relativist cannot allow any particular perspective to have pre-eminence, and his world must therefore become a chaotic mish-mash of appearances. Murphy is particularly scathing

about McGilvary's claim that even opposing views are equally valid in their own perspective, and that this is actually an advantage of his theory. But this does not entail that "everyone is equally correct" - all it claims is that there are always other points of view and as long as the limitations of a perspective are recognised at its adoption, there might be something to learn from it.

We may also argue that it is quite consistent with McGilvary's theory that some perspectives, e.g. the ordinary perceptual usage, can have some pre-eminence. The perspective theory is only pointing out that *in certain limited perspectives* the railway lines *are convergent.* Ordinary perceptual usage happens to assume a perspective in which the lines are physical objects in three dimensions. In that, the ordinary, perspective, the lines not only are 'really' parallel but they actually *look* parallel. It requires a shift from the ordinary perspective to see them as convergent, and the term 'looks' or 'appears' in *that* context is a natural signpost to that perspective. In such a perspective (e.g. that of the artist) they are not just convergent, but converge at a definite angle in a definite direction which can be measured. They could not carry a train if it were not so. A similar argument applies to the green apple - if it were not green in plain sunlight, it would not appear the colours it does in other conditions or perspectives. This being the case, it looks green when the camera or artist says it is greyish-blue.

Seen this way, the ambiguity to which Murphy refers seems less of a problem. A privileged perspective is privileged not because it somehow shows the reality of the object more clearly than other views, but because it is more appropriate to the particular purpose of looking; that is, we look for the usefulness rather than the God's-eye view. If the real, measured shape of something is required then indeed certain perspectives will be of more use than others; one view might show the overall shape, another might show the ruler reading with a minimum of parallax, and so on. To ask for 'the truth' about something is futile only because the question is not specific enough; to ask for 'the truth: is that table really round?' immediately provides

something to look for. All perspectives are equal, but some are more conducive to effective measurement, for example, than others. This is no mystery.

On the matter of directness and incorrigibility, the perspective theory says that what we see directly is the object as it is in that perspective, and we can say further that if there is error it is in mistaking one context for another, as Murphy himself nearly suggested when he mentioned "the estimates we make, given sensations, of the real properties of things observed".

But all this has done is to make the theory independent of the monism-dualism debate. We can answer the charge that it would entail dualism by saying that judgment between different perspectives must itself depend on another perspective which encompasses the relevant factors. It does not depend on there being a metaphysical "subject" to be a "judge" - that turns out to be a quite separate question.

Finally, what about hallucination and illusion? Murphy asks, in a third article reprinted in the same volume:

> "Are we to say that the drunkard sees pink rats correctly, and that what he sees are real, though epiphysical, constituents of the natural world around us? And if we do say this, then what, in this sense, would *not* be a correct disclosure of the world to consciousness except perhaps an "appearance" that resulted from a violation of the laws of nature?
>
> .
>
> "McGilvary does not consider this question." (Murphy, 1959, p89)

The pink rats that the drunkard sees before him are not objects in the world, so the argument goes, and so perspective realism must founder. McGilvary is not a great deal of help, although he considers a related phenomenon - that of experiences resulting from electrical stimulation of the cortex - because he is concerned to explain consciousness as 'epiphysical' and this raises more problems than it solves.

But we *can* talk about context, purpose and even illusion without a particular philosophy of mind, provided we are careful not to make unwarranted extrapolations from one perspective to another. The perspective of the drunkard is, like that of everyone else, shifting all the time and he would as likely as not regard the rats as evidence that he has had too many. The images exist; no one denies that, and physiology can account for them at least in principle. We would consider it odd if all drunkards saw rats in the same places doing the same things. Similarly I can see something, and turn out in another perspective to be mistaken as to what it was I saw; I can even be deliberately mistaken e.g. when looking for fairyland in the clouds. Confirmation (in the everyday sense) depends as much on other perspectives as it does on duplicating the original, as in repeatable scientific experiments. What matters is not that our sensory apparatus is capable of playing tricks on us - this is unavoidable, even essential - but that we should be open to the possibility of using other perspectives to gauge how cautious we need to be. What we perceive might not be incorrigible, but it can be true enough for the present purpose. We still perceive the thing, but the truth may be unattainable because of various kinds of physical and theoretical obstacles to clear perception. Thus far the theory is trite, says Hirst; it does not in itself separate the true from the untrue.

This is the first step in our argument, that the spirit of perspective relativity is acceptable to all. The next step is to show that nevertheless something useful can be made of it. Readiness to move about among different views is the most promising way to get close to clear perception of the world. This policy is advocated in the movement, which critics call "irrationalist", in the philosophy of science which will be examined in the next section.

2.2 Progress in the new philosophy of science

Perspective relativity is closely related to the work of the pioneers of 'the new image of science' with its central concept of theory-dependence of observation. Therefore this chapter should include a brief survey of the main theses of N.R. Hanson, T.S. Kuhn and P.K. Feyerabend, and of some of their critics. We can then relate our results to PR.

A related but different concept, that of underdetermination, is also relevant. This is the 'Quine-Duhem' thesis, that "Any statement can be held true come what may, if we make drastic enough adjustments elsewhere in the system" (Quine, 1953 p.43). The "come what may" refers to observations which might seem to falsify the statement.

These two concepts form part of the movement which Stove (1982) has criticised as "irrationalist". Stove's criticism is levelled at four authors, namely Popper, Lakatos, Kuhn and Feyerabend. The argument will be considered in Section 2.2.3.1.

There is also a growing literature on the 'sociology of scientific knowledge' which has been inspired by these ideas. Perspective terminology is used a great deal in this literature, and it seems odd that, even though it is used so much, it does not seem to be taken seriously. (Stove offers an explanation for this pervasive levity.) For example, Lukes comes very close, in his survey of various forms of relativism:

> "...perceptual relativism, provided it is not given an 'idealist' formulation, is simply the (doubtless fertile) hypothesis that how we recognize and interpret what we see will be relative to (divergent) languages or conceptual or theoretical frameworks." (Lukes (1982) p.267)

While a perspective is not the same as a framework or a language, the notion that there is something there, "doubtless fertile", is nevertheless passed over. Later in the same article (indeed, right at the

end of the book) he discusses various forms of what he calls "perspectivism", but because he confines his attention to the social sciences, he only appears to consider the people under study to have different perspectives. The scientist's problem then is that of finding "perspective-neutral" data with which to judge them. The idea that the social scientist's own observations are perspective-relative is not considered. Lukes has come very close to us, then veered away with remarks that have no relevance at all to our purpose in this project. Yet again, it seems that PR has escaped notice because it is too simple!

2.2.1 Theory-ladenness and underdetermination

It was Hanson who, apparently, first coined the term "theory-laden". He applied it to the activity of seeing, and to terms, especially "causal talk". Hanson was among the first to bridge the gap (Stove would say foster the confusion) between the history and the philosophy of science. His approach was to look at theories of philosophy of science through the lens of microphysics rather than vice versa:

> "Let us examine not how observation, facts and data are built up into general systems of physical explanation, but how these systems are built into our observations, and our appreciation of facts and data. Only this will make intelligible the disagreements about the interpretation of terms and symbols within quantum theory." (Hanson, 1958, p3)

In the same spirit, he argues that law sentences, such as the Law of Inertia, can be put to a variety of uses and that philosophers who try to give one answer to such a question as: "what is the logical status of law-sentences?" are addressing themselves to a question rather like "what is *the* use of rope?" (Ibid.,p98). A law-statement may be used as a definition, or as an a priori statement, a heuristic principle, an empirical hypothesis, a rule of inference or whatever. Its status depends on the actual place it has in the concept-system of the physicist using it on a particular occasion.

Hanson's main emphasis is on the observation itself and not to the same extent on the language in which it is reported - although of course this is of central importance. He discusses seeing, and its relation to 'seeing as' and 'seeing that'. While seeing is not to be identified with seeing as, consideration of the latter brings certain features of observation into sharp relief, and 'seeing that' even more so. To have a retinal image is one thing; to observe an X-ray tube on the table involves much more - it involves knowledge of some kind, about X-ray tubes and about what will happen if certain things are done to X-ray tubes. Something counts as an observation only if it is appreciated in the light of some knowledge - usually causal knowledge.

So the more an observation involves causal knowledge, the more theory-laden it is. If colour-patches, sound frequency distributions and the like are all that is noted, then no causal relationships are involved and no explanation is assumed. ("There are as many causes of x as there are explanations of x." Ibid., p54) That it does not really count as an observation is reflected in the fact that it is reported in a ("sense-datum") language which is not the language in which the enquiry is conducted - that of the theory. Theory, or knowledge, is a "pattern of threads...there in the cloth" (Ibid., p22) - the organisation of the conceptual apparatus which "allows physicists to observe new data as physicists, and not as cameras" (loc.cit.).

The idea of underdetermination is attributed to Duhem and has been promoted by Einstein and Quine, among others. It says that any theory can be put forward to explain any set of data, if radical enough adjustments are made elsewhere in the overall system of beliefs. The argument is briefly as follows: no single theory can be extricated from its collateral assumptions, so it cannot be refuted. If a theory's predictions do not materialise, we can only say that the theory and the assumptions are not both correct. We could always keep the theory if we made adjustments in the assumptions, and conversely, there are always alternative theories which are consistent with the evidence. While the logic of Duhem's original argument was refuted by Grunbaum (Grunbaum, 1960), the idea remains plausible because of the

enormous problem of ambiguity.

These two ideas, underdetermination and theory-ladenness, are often cited as arguments for the study of a sociology of science. This is fine, as long as the sociologists remember that they, too, are scientists. But Stove (1982) argues that the way these notions are used by the "irrationalists" Kuhn, Feyerabend *et al* has had the effect of *reducing* the philosophy of science to a sociological study, thereby devaluing the scientific endeavour completely - a sort of *reductio ad absurdum*. This charge of irrationalism must therefore be met, and will be examined in Section 2.2.3.1.

2.2.2 The concept of a paradigm

Relativism is a thesis which Popper has called "fashionable" (Popper, 1965 p.56). His remark is addressed to Kuhn. Two aspects of Kuhn's work are of particular interest to perspective relativity: one is his answer to the charge of relativism, the other is the argument that there is a sense in which scientists working according to a different paradigm are actually "responding to a different world" (Kuhn, 1970 p.111). We shall return to the relativism issue shortly, but first examine the concept of a paradigm and the different worlds.

A paradigm is a set of commitments more fundamental than a theory:

> "In learning a paradigm the scientist acquires theory, methods and standards [governing permissible problems, concepts and explanations] together, usually in an inextricable mixture." (Kuhn, 1962 p.109)

The idea of a paradigm is original to Kuhn. In the Preface to his (1977) he tells us that the insight arose from a deep puzzlement in reading Aristotle's discussions of motion in the *Physica*:

> "Even at the apparently descriptive level, the Aristotelians had known little of mechanics; much of what they had had to say about

it was simply wrong. No such tradition could have provided a foundation for the work of Galileo and his contemporaries. ... When dealing with subjects other than physics, Aristotle had been an acute and naturalistic observer. In such fields as biology or political behaviour, his interpretations of phenomena had often been, in addition, both penetrating and deep. How could his characteristic talents have failed him so when applied to motion? How could he have said about it so many apparently absurd things? And, above all, why had his views been taken so seriously for so long a time by so many of his successors? ...was it conceivable that his errors had been so blatant? ... I all at once perceived the connected rudiments of an alternate way of reading the texts ... Aristotle's subject was change-of-quality in general, including both the fall of a stone and the growth of a child to adulthood ... the subject that was to become mechanics was at best a still-not-quite-isolable special case. More consequential was my recognition that the permanent ingredients of Aristotle's universe...were not material bodies but rather the qualities which, when imposed on some portion of omnipresent neutral matter, constituted an individual material body or substance. ... In a universe where qualities were primary, motion was necessarily a change-of-state rather than a state. ... Lessons learned while reading Aristotle have also informed my readings of men like Boyle and Newton, Lavoisier and Dalton, or Boltzmann and Planck. Briefly stated, those lessons are two. First, there are many ways to read a text, and the ones most accessible to a modern are often inappropriate when applied to the past. Second, that plasticity of texts does not place all ways of reading on a par, for some of them (ultimately, one hopes, only one) possess a plausibility and coherence absent from others."
(Kuhn, 1977 pp xi-xii)

So the original concept of a paradigm was a device to facilitate sympathetic reading of material which was otherwise either very hard to understand or blatantly wrong. This notion, that a paradigm is a key to communication, has been largely neglected in favour of the

notion that it is a barrier which excludes all but those in the know, and precludes any possibility of finding the truth about anything.

2.2.2.1 Masterman's analysis

One of the best analyses of the paradigm concept, and one of which Kuhn himself approves, is Masterman's article (Masterman, 1970). All the different uses of "paradigm" in Kuhn's (1962) are listed, and the result is a division into three categories, as follows: the first sense is that of a metaphysical world-view, and this is the way most philosophers who have criticised the concept have seen it; the second sense is that of a concrete scientific achievement and the set of scientific habits to which the achievement gives rise; the third sense is that of an artefact or construct - a toolkit or a "crude analogy". The first is metaphysical, the second sociological, and it is the third, the most concrete sense, which Masterman regards as the most fundamental.

The argument for this stems from Kuhn's view that normal science is essentially the solving of puzzles. Something must provide a structure for formulating puzzles and showing what form a solution would take. The first two senses of "paradigm" reflect the abstract (metaphysical) and concrete (sociological or practical) aspects of normal science once the paradigm has taken root, but

> "the real problem...is to describe philosophically the original trick, or device, on which the sociological paradigm (i.e. the set of habits) is itself founded." (Masterman, 1970 p.70)

The most fundamental aspect of a paradigm is the way it got started in the first place and, she argues, the original device is an artefact

> "*for only with an artefact can you solve puzzles*" (loc.cit, her italics).

A paradigm comes into being when an artefact (e.g. a picture of some-

thing) is suddenly seen to provide a way of looking at something else, which as yet has no theory to explain it. Masterman argues that the artefact thereby becomes a crude analogy - an analogy because in times of crisis the paradigm behaves exactly like an analogy which has been pressed too far, and crude because if it were not so, i.e. if it were precisely statable in terms of a mathematical model, it would be comparable with other paradigms. It is the crudeness - the original concrete artefact - which is characteristic of Kuhn's notion of a paradigm as distinct from the theory which eventually turns the problem into a puzzle.

Three kinds of crude analogy are isolated: pictures (e.g. the Genetic Code lent concreteness by picturing it as a language), models (e.g. a model of a macromolecule constructed - or constructable - out of wire and plastic), and metaphor ("an analogy-drawing sequence of word-uses in natural language"). Masterman says that this is an exhaustive list.

2.2.2.2 Different worlds

The origin of a new paradigm, then, is a concrete analogy constructed using the tools provided by picturing, modelling or linguistic (poetic?) techniques. This helps us to understand the other two senses of "paradigm", and to see what Kuhn might mean by "different worlds". From the analogy comes a range of metaphysical assumptions on the one hand, and a set of practical habits on the other. The cruder or more concrete the initial analogy, the more likely it will be that the assumptions and habits will be incomparable, or "incommensurable", with those stemming from another paradigm (see Ibid., p.80). It is in this sense that the *worlds* inhabited by scientists working according to different paradigms are different. It is the analogy and not the 'world out there' which lends concrete interpretation to the mathematics and thus provides a way of seeing whatever it is being used to represent. The analogy is itself, while it lasts, the world the scientist observes.

2.2.3 Relativism versus progress?

Since Hanson and Kuhn, it is now common currency (and hence, perhaps, "fashionable") to recognise that in order to understand what scientists talk about it is necessary to be 'in the know' in more than just the sense of having become acquainted with the established facts in their subject-matter. Students are trained to *see* the subject-matter *in the way that their teachers see it* - only thus can they understand the puzzles to be solved. It follows that, if there is an alternative way of seeing the subject-matter (Duhem), the alternative might not be seen from the established viewpoint, and when it is seen the choice between the two ways of looking must depend on considerations other than what is observed in either of them.

Popper's response to Kuhn is to reject the thesis that it is impossible to scrutinise a paradigm while it is being used:

> "I do admit that at any moment we are prisoners caught in the framework of our theories; our expectations; our past experiences; our language. But we are prisoners in a Pickwickian sense: if we try, we can break out of our framework at any time. Admittedly, we shall find ourselves again in a framework, but it will be a better and roomier one; and we can at any moment break out of it again.
>
> "The central point is that a critical discussion and a comparison of the various frameworks is always possible."
> (Popper, 1965 p.56)

Even so, this argument admits that paradigms can be scrutinised only in hindsight - from "a better and roomier one". It is not clear what is meant by "roomier", except as a continuation of the analogy of the prison. The roomier a prison becomes, the less like a prison it is.

Kuhn replies (Kuhn, 1970) that all the usual criteria for choice between competing theories (such as accuracy of prediction, number of

problems solved, simplicity, scope etc.) are still just as relevant as they always were, but they can only be guidelines. They are commonly held values, and do not constitute rules which provide a calculus for choice of theory. Therefore in actual practice a great deal of persuasion and appeal to intuition may be required to convince working scientists that the new paradigm is worth the switch. (Feyerabend emphasises this point.) This, however, does not mean that there is no progress in science - there is no danger of returning to phlogiston and anyone told of the phlogiston theory today would realise that it is not a new theory but an old and superseded one.

Kuhn is not, therefore, defending "irrationality", but only pointing out that the existing criteria, or values, of theory-choice leave room for differences of judgment which are still within the bounds of rationality, and moreover, that we do not possess a more definitive way of choosing between theories. Popper's statement that paradigms can always be compared and critically discussed is not denied - Kuhn just removes its significance. The only way to find out more is to look at the scientific process, instead of taking it for granted or, worse, postulating methodologies from an armchair. (For an illuminating study of how scientists actually go about their business, see Ravetz, 1971.)

So the only area in which Kuhn might admit to being a relativist - and

> "if the position be relativism, I cannot see that the relativist loses anything needed to account for the nature and development of the sciences" (Kuhn, 1962 p.207)

- is the problem of approximation to 'the truth'. As Kuhn has pointed out, this is a smaller problem than it seemed before. What is needed is a clearer notion of 'progress' on the one hand, and 'truth' on the other. Science progresses in the sense that it is an irreversible process, and in the sense that each paradigm is better than its predecessor according to a wide-ranging set of (admittedly vague but) useful criteria of theory-choice. If these criteria were regarded as

pointers to 'the truth' by definition, there would be no problem - and as we have seen, this is quite close to Popper in a certain mood. Yet Popper is not content; he believes in absolute truth "in Tarski's sense" - in the sense, presumably, in which snow is really white. The problem that Kuhn points to here (Kuhn, 1970 p265) is that if this conception is applied to the choice between two competing paradigms, it assumes that the two sides agree precisely on what it is that they are talking about and that they both understand the sentence in question in the same way. This, Kuhn has taught us, is by no means to be assumed.

We should remember the point made earlier that any statement claiming to be absolute must include its entire relevant context. Even the ultimate roomy paradigm must be made explicit.

2.2.3.1 Stove's criticism of "irrationalism"

David Stove criticises this whole movement in a closely argued book (Stove, 1982) to which we must give some answer. He traces the rot back to Hume's famous conclusion that there is no reason, from any source, observational or a priori, to believe any contingent statement about the unobserved. Stove disagrees with Hume's conclusion, and finds the gap in the argument at the point where Hume makes the inference from the incurable fallibility of what is now called induction to the utter unreasonableness of it. Stove argues that, given the indubitable conclusion that no argument from the observed to the unobserved can be valid, it does not follow that the observed provides no reason at all to believe something about the unobserved. Hume's hidden premise, Stove tells us, is deductivism - the view that only an absolutely conclusive argument will provide any reason to believe a proposition about the unobserved. In other words, only the best will do.

It is this deductivism, Stove says, which is the root of the trouble because Popper, Kuhn and the others have taken it on board. Where Carnap, Hempel and others have bowed to the inevitable and turned

their attention to working on a non-deductive theory of probability, confirmation and explanation, "our authors" have ignored or ridiculed such attempts as chasing second best. They are therefore reduced to trying to deal with the consequence of their perfectionism, namely, that there can be no scientific knowledge and no scientific progress.

The result of this state of affairs - this deductivism coupled with scepticism about the observed - is considerable confusion. Stove accuses the authors of using literary tricks (in particular what he calls "sabotage of logical expressions", whereby such terms as 'confirms' and 'falsifies' cannot be used directly and so are embedded in epistemic statements about scientists) to foster the confusion between the history and the philosophy of science. This, coupled with hostility towards the work of Carnap and Hempel on non-deductive logic, has resulted in a kind of levity, a lack of seriousness on the part of our authors and an "amazing" lack of rigour. Stove argues that there are two reasons for this, one, that a perfectionist does not distinguish between a greater and a lesser imperfection and so is careless in his dealings with either, and two, that the deductivist thesis is itself frivolous and *enfant-terrible*. As far as frivolity is concerned, the only exception of the four authors considered is Kuhn, who, Stove says, is truly in earnest and really believes that there has been no progress in science in the last four centuries.

We have already seen that Kuhn believes nothing of the sort if he, of all the four, can be said to mean what he says. The point about deductivism is, however, important. We have seen it in Popper, in his argument with Kuhn about relativism; Popper's own solution, as Stove points out, is to postulate methodologies to turn a non-deductive argument into a deductive one. The comment that Popper, of all writers, is an "enfant-terrible" is surprising, but Stove does cite some remarkably sloppy passages in Popper which, he suggests, indicate that the writer does not really take seriously the things he is saying. The suggestion that Kuhn, Lakatos and Feyerabend are also deductivists at bottom is also surprising at first, but it does explain why they take no interest in confirmation theory and probabil-

ity, preferring to study the historical development and overthrow of actual scientific theories, and the relation between such theories (as opposed to those of logic) and observation.

But to say that deductivism itself is frivolous (but, like the priesthood, indelible) when applied to science is only a part of the matter. Nowhere does Stove criticise the idea of a paradigm, which is much more than Popper's postulated methodologies. That paradigms exist, and that they change, is obvious in the historical perspective that these authors outline. That paradigms turn problems into puzzles which can be solved, and are solved, is quite acceptable to Stove, even though the motivation for such a device is precisely to offer a means for deductive inferences in science. What he finds unacceptable is that these solutions lose all of their value when a new paradigm supersedes the old.

Indeed, Kuhn and Feyerabend are ambiguous on this point. To reject the cumulative view of science can be taken to entail a rejection of any but the current view, with the added awareness that this view is also subject to revision. It does not follow, however. All that is being rejected is the idea that new theories are more or less simple extensions of the old, and that therefore all scientific observations are on a par. We can see, from the historical perspective, and with the benefit of Kuhn's lessons from reading Aristotle, that that is not so. All that follows from the rejection of the cumulative view is that the context must be taken into account in any report of any observation. The ancient observations are no less important; only they must be understood to include the intellectual climate in which they were made. Kuhn found a way, not to explain why Aristotle was wrong about mechanics, but to explain to what extent he was correct. The result was a more, not less, sympathetic reading of him.

As for the charge of levity, the principal and most blatant offender is Feyerabend, to whom we shall now turn.

2.2.4 The flippant spirit

In **Against Method,** Feyerabend gives a graphic account of certain aspects of the history of science, in particular the work of Galileo, to illustrate his own approach to the philosophy of science. We are shown that the *only* fruitful approach to the development of science is the spirit of "anarchism" - that is, to try as far as possible to get outside the existing paradigm. The principle that "anything goes", far from destroying progress, is the only principle that does not inhibit it. The argument is even put forward explicitly as a defence of "irrationality", with the following balancing statement:

> "There may, of course, come a time when it will be necessary to give reason a temporary advantage and when it will be wise to defend its rules to the exclusion of everything else. I do not think that we are living in such a time today." (Feyerabend 1975 p.22)

Though he uses the term 'anarchism', Feyerabend is at pains to point out that this is meant in the spirit of

> "a flippant Dadaist and *not* ... a serious anarchist' (Ibid., p.21 footnote).

A sense of flippancy is essential to the scientific enterprise - as soon as it is taken too seriously (e.g. as a search for the truth) it begins to die. He is arguing that there is nothing inherent in science which makes it superior in all respects to any other way of looking at the world, and since the best way to examine a framework is to create - or import from elsewhere - a quite different one which clashes with it, the scientific enterprise could well benefit from far-fetched, even mythical, ways of seeing.

This could all look very like an attempt to take Kuhn's position to an absurd extreme. It may be that that depends as much on one's sense of fun as anything else, but that does no harm. Anything which helps us to get a sense of proportion is worth carrying, but it must be held as

lightly in the hand as anything else. Feyerabend's levity is serious, almost urgent in its intensity, a point which makes Stove laugh. But it must be remembered that Feyerabend's book was originally intended as a sort of devil's advocate, to be published with a reply by Lakatos who tragically did not live to complete it. It was therefore written in anticipation of a competent rejoinder, and that is why it is phrased in such strong terms.

With this new sense of proportion, we can see that Feyerabend is neither extreme nor absurd. True, there is a great deal of historical example, as we are subjected to yet another perspective on the Copernican revolution. Feyerabend does, however, take more seriously the actual practice of science, as distinct from its methodological ideal, than the others.

> "...some of the most important formal properties of a theory are found by contrast, and not by analysis. A scientist who wishes to maximize the empirical content of the views he holds and who wants to understand them as clearly as he possibly can must therefore introduce other views; that is, he must adopt a *pluralistic methodology*. He must compare ideas with other ideas rather than with 'experience' and he must try to improve rather than discard the views that have failed in the competition. Proceeding in this way he will retain the theories of man and the cosmos that are found in Genesis...he will elaborate them and use them to measure the success of evolution and other 'modern' views. He may then discover that the theory of evolution is not as good as is generally assumed and that it must be supplemented, or entirely replaced, by an improved version of Genesis. Knowledge so conceived is not a series of self-consistent theories that converges towards an ideal view; it is not a gradual approach to the truth. It is rather an ever increasing *ocean of mutually incompatible (and perhaps even incommensurable) alternatives*, each single theory, each fairy tale, each myth that is part of the collection forcing the others into greater articulation and all of them contributing, via the process of compet-

> ition, to the development of our consciousness. Nothing is ever settled, no view can ever be omitted from a comprehensive account." (Feyerabend, 1975 p.30)

Feyerabend tells us to read him any way we like, and so we shall take the "process of competition" to be light-hearted (though not light-minded), in the sense that there are no losers. As we shall see in the succeeding chapters, incompatibility of two perspectives does not necessarily imply that one of them is quite wrong. What it does mean is that they cannot both be viewed at the same time, and many quite innocent perspective differences have this property. Again, Stove's fear that ancient ways of looking are totally destroyed by new paradigms is unfounded. Feyerabend, as well as Kuhn, is asking us to look at them again, not to reject them as the initial rise of science was wont to do.

2.2.5 A summary

Thanks to Hanson, Kuhn and Feyerabend, the philosophy of science lends itself very well to the terminology of perspectives, and indeed these writers and others use the terms 'perspective' and 'point of view' quite freely. If we were now to try to explain the contributions of these writers to the philosophy of science using perspective terminology (analogy, perhaps, at this stage), we would see the following advantages: first, it will be easier; secondly, ambiguity (such as that which has arisen from the idea of a 'paradigm') will be more readily avoided or at least detected and diagnosed; thirdly, the terminology itself can be scrutinised, both for its assumptions and its appropriateness; and fourthly, it has all the advantages of 'crudeness' - it is not mathematics, no single perspective need be overworked, and it is intuitively useful and clear.

To summarise: Hanson first drew our philosophical attention to the idea that what is observed depends on the perspective of the observation. Kepler and Tycho Brahe each see a different thing in the east at dawn *to the extent that* their perspectives on the sun are

different. It is not a matter of seeing the same thing and then interpreting it differently - the 'interpretation' is *an integral part* of the perspective ("the pattern of threads is there in the cloth").

Kuhn elucidated this idea by explaining that the perspective incorporates basic assumptions, habits of practice and of thought, a metaphysical world-view and whatever concreteness the field of view has. Perspectives improve upon their predecessors in usefulness, simplicity, scope and so on. Normal science is conducted in the current established perspective, which students have to be taught to enter, and which remains unquestioned until another perspective seems more useful, simpler, wider in scope etc. The switch cannot come about by explanation, discussion and persuasion alone - a perspective is of such a nature that it must also be shown, by invitation to enter and 'see for yourself'. The experience in this respect resembles a religious conversion. The succession of scientific perspectives constitutes progress no less than the articulation of a single perspective does.

Feyerabend went further and told us that the *only* principle of scientific methodology which does not inhibit progress is "anything goes", and that it is necessary to run several perspectives, even mutually incompatible ones, at once in order to articulate any of them as fully as possible.

Thus an outlook (i.e. relativity) which is often very helpful in other fields such as everyday life, art and even religion and morality is now being applied to science, including natural science. At once, it seems to *matter* to us. For a perspective is a subjective sort of thing and if there is no objectivity even in science, then we have 'nowhere to lay our head'. There is no point, it may be thought, in pursuing the scientific enterprise in any field if everything we are going to observe is determined almost entirely in advance by the perspective adopted by the observer.

Therefore Popper calls Kuhn's thesis "dangerous", and insists that

scrutiny of the perspective is by no means impossible since we can at any time break out of it into a better and roomier one. (By implication, the roomiest perspective of all is the truth - but by his own argument this cannot be scrutinised, since there is no roomier perspective in which to view it.) Feyerabend takes the opposite view - that there are incommensurable perspectives, that this is an important aid to progress which should be fostered, and that no perspective is better than any other except relative to the purpose in hand. If the current perspective does not serve the purpose, it may well be worth looking in the most unlikely places for one which does. It is not necessary to have a destination (e.g. the truth) in mind.

The difference between Popper's and Feyerabend's viewpoints, as cited here, represents a difference in strategy, and our notion of perspective relativity will aim to indicate to what extent, and in what respect, they are both appropriate. Relativity need not be dangerous, and absolutism need not be bigoted, though of course they can be so. 'Objectivism' and 'subjectivism' (in any sense) are also both equally appropriate, and both equally inappropriate. The slogan is: It all depends on the perspective.

This is not being non-committal. PR is not an escape from the problem, a blanket statement that the perspective you choose doesn't matter; on the contrary, it points up the need for some kind of method or device for stepping between different perspective spaces to help to detect what is relevant and appropriate and what is not.

CHAPTER THREE : ORDINARY PERSPECTIVES

Contents: Page

3.0 Introduction

The theoretical formulation of Perspective Relativity that will be outlined in Chapter 4 is probably one of many that would suit the purpose and is therefore more an example of what can be done with the idea than an attempt at the final word on the subject. In the present chapter we must first discuss the everyday, general notion of a perspective and of perspective relativity in an informal way in order to see how far it can take us as it stands without a formal terminology. At the same time we can assemble problems and points that must be accounted for or included in any useful theory of PR.

3.1 Ambiguity and needless controversy

The original idea arose from the observation that most arguments on matters of any generality have no genuine point at issue. As we saw in Chapter 1, such controversies are a result of ambiguity in the bone of contention. In ordinary perspective terminology, a statement can be ambiguous if more than one perspective has a place for it. A linguistic utterance can indicate any perspective which is not explicitly excluded by it, or implicitly excluded by context. Any such utterance may therefore be said to partition any set of perspectives into three classes: those perspectives in which it is true, those in which it is false, and those in which it is irrelevant or meaningless. Here are some examples:

One example, already mentioned, is Tarski's famous sentence "snow is white". It is true enough, for all the ordinary reasons. It is also false; snow is often pink or orange in a sunset, blue in shadow, greyish-brown on the road, and so on (as any camera will show). Finally, it is irrelevant; snow is transparent, or lattices of molecules, or atoms, or wave-packets, or tiny distortions in space-time - in any of those perspectives it makes no sense to say what colour it is. To ask whether "snow is white" is a true, false or meaningless representation of a fact in the real world is to ask a silly question, like saying "How long is a piece of string?".

Another example might be 'a nuclear blast is a beautiful sight'. Value judgments are, in an important respect, relative to perspective - or, at least, to the purpose (to which topic we shall of course return). Any absoluteness, for those who require it, would reside in the choice of the appropriate perspective and not in the utterance by itself. 'Stealing is wrong', for example, assumes a perspective in which ownership is respectable. Exactly what kind of difference a value judgment makes to a perspective will be explored later on.

Relativity applies equally to specific, here-and-now utterances, such as: 'you'll find my mug on the table over there'. There are all sorts of possible alternative perspectives, apart from the one which includes physical objects in space: e.g. the aesthetic effect against the rest of the decor, or the light and shade effects (e.g. for painting the scene), or the currently understood physical forces that stop mugs falling through tables, or an example for the contemplation of an anti-gravity or teleport machine. In some of these perspectives, 'the mug is on the table' does not make sense, and the physicist or inventor shifts perspective with a jolt when some kind soul takes it away to make him coffee. There might also be some perspectives in which the sentence under discussion is false, as distinct from meaningless; someone might want to say that the mug is not strictly on the table, but on a coaster which is in turn on the table. This might be important e.g. on a polished surface.

This is not the same as saying that the mug, in the original perspective, might not be on the table. A perspective is not a possible world. It is also not the same as saying that it is all a matter of how the terms are defined; the perspective is prior to the meanings of the words, in the sense that the perspective must be understood before the words make any sense. Diagrams and gestures, which do not carry truth-values, often do the job (of pointing to a particular perspective) better than words.

In actual practice, of course, no-one would dream of asking 'what exactly do you mean by that?'. For all the perspective relativity,

our homely utterance is unproblematic, for two reasons.

The first reason is that a perspective which includes physical objects such as mugs and tables and coffee occupying places in space and time is one with which we are all familiar and which we inhabit a great deal of the time.

The second reason is that, once the perspective is established, the actual mug and table indicated are easily identified by looking 'over there'. This brings us to genuine controversy, where the bone of contention is clearly understood by both sides.

3.2 Genuine controversy

A perspective is like a conceptual scheme or categorial framework, with one important difference: namely, the explicit significance of the point of view. A perspective, like any framework, paradigm, language-game, set of opinions etc., is essentially a slicing-up of the world - a set of distinctions and dimensions upon which ontologically accepted elements find their place. A fact, therefore, is not something that can be established unless the appropriate distinctions are agreed upon. Once this is done, a suitable point of view can then be sought from which to see how the world looks in that perspective. Only when the perspectives are matched in all relevant respects can there be a genuine point at issue on a matter of fact (such as: is there a tree in the quad or not? is there such a thing as 'vital energy'? can a computer think? and so on). If the perspectives do not match, then the discussion is at cross-purposes and communication, at least on the topic(s) under discussion, is not taking place. If, on the other hand, they are matched, then Nature can be asked to provide arbitration provided that: a) there is access to a suitable point of view, and b) the relativity to the perspective is seen to be an integral part of the answer (if it matters). Here we have the beginnings of a strategy for resolving such problems.

3.3 Three aspects of a perspective

In the discussion so far perspectives seem naturally to divide into three distinct aspects which we can call Theory, Practice and Experience (Being There) respectively. Theory is the articulation of the perspective, which is necessary for communicating it by representations and for making sense of what we see; Practice is the practical aspect, where we move towards a suitable point of view, or interact with the world as seen in the perspective; Experience is just to be at the point of view and thereby experience the world in the chosen perspective.

The scientific endeavour, especially that part of it which Kuhn calls "normal science", seems to reflect these three aspects quite clearly. The Theoretical aspect involves the articulation of the paradigm, the formulation of questions, the design of experiments in the light of the chosen paradigm and the interpretation of actual and possible results. The Practical aspect of the enterprise involves the building or other procurement of suitable apparatus and tools, and the manipulation of these to arrive at an appropriate point of view. Once he has manoeuvred himself to a point of view in a certain paradigm, the scientist can then look and see how the world is in that perspective - Being There.

The three aspects are quite distinct, and the problems associated with the scientific endeavour find themselves partitioned accordingly. The fact that the aspects are intimately related in any particular perspective does, however, often blur the issue of which aspect a particular problem belongs to.

For example, the three major classes of theory of truth - correspondence, coherence and pragmatic - might be considered to address themselves to different aspects of perspectives. The coherence theory, it seems, addresses itself to Theory; the various attempts at a correspondence theory are addressed to Being There and Theory; and the pragmatic theories lay emphasis on practical possibilities. As in almost all philosophical disputes, they are all equally right, up to a point.

They all point out important elements lacking in the others. The difference is one of emphasis, and not necessarily of substance.

Wittgenstein's change of emphasis from the Tractatus (TLP) to the more friendly Philosophical Investigations (PI) is another case in point:

> "A proposition can be true or false only in virtue of being a picture of reality" (TLP, 4.06)
>
> "Think of the different points of view from which one can classify tools or chess-men." (PI, para. 17)

The logical considerations in the TLP are still as valuable as ever, and perhaps it could be said that they still apply within coherent perspectives. The PI points over and over again to the fact that there are many possible perspectives, some of which are mutually incompatible owing to such factors as fuzzy borderlines and the ways language is used. Thus where the TLP is devoted to developing the Theory aspect on the whole world, the PI considers also the practical aspect of the perspective and finds that a multiplicity of views can be generated by an utterance.

3.3.1 Changes in the world - the Practical aspect

Change in the world is not a matter of an alteration in the structure of the perspective - that would be a perspective shift (though not necessarily a revolution). Observed change, the dynamic quality of the world in view, might be simply enough represented by adding the time dimension to the perspective space if it was not already there. Time-lapse and slow-motion photography are examples of techniques for bringing slow and very fast changes into view.

Particular perspectives view particular classes of change, and a change of one sort in one perspective might be something quite different in another. Furthermore, change of any sort in one perspective might be stasis in another; it is this kind of invariance which makes

cybernetics so compelling. Very often the continual movement is irrelevant as long as certain pertinent factors remain constant.

This dynamic quality, the state of constant flux, was a bone of contention in pre-Socratic Greece between Heraclitus, who held that change is the essence of matter, and Parmenides, who held that change is logically impossible. Gregory writes:

"The ancient controversy...between the positions of Parmenides and Heraclitus - between unchanging and changing as the basis of physical reality - is alive now in present theories of matter. It is the controversy between indestructible unchanging atoms and changing fields. Is physical reality indestructible units, or is it ever-flowing flux? to put this another way: what is the *status* of matter? In thinking about form and matter, what Heraclitus and Parmenides questioned remains central." (Gregory, 1981 p.114)

Gregory adds that Parmenides' grounds for his argument, well illustrated by the famous paradoxes of his disciple Zeno, no longer hold water since (in particular) Russell's theory of logical constructions. Gregory, in this discussion, points to the way that Parmenides' philosophical theory had the power to filter out and disallow something that is obvious to all of us - namely, that changes do occur. PR would point out that this filtering action of an articulated perspective need not disallow the other views but challenges them to be articulated as well, so that the perspective relations can be explored.

Cybernetics is a clear example of an attempt to articulate perspectives which filter out irrelevant change and concentrate on, say, keeping certain essential variables within limits. In these perspectives the only changes which are seen at all are those which relate to the purpose in hand and are seen as discrepancies to be corrected.

Of interest in this connection is the concept in automata theory of the 'world automaton'. The idea is that a learning automaton can

build up a picture of the world as a second automaton, the world automaton, whose outputs (or states) are its inputs and whose inputs are its outputs (see, for example, Aleksander and Burnett (1983), ch.7).

We may regard the practical aspect of a perspective as carrying an associated toolkit with it, which enables the point of view (which might be at the eye, or the tip of a finger or the end of a probe) to be moved, and practical tasks to be carried out, in that perspective space. As a simple example, consider a computer game in which, among other things, to fire a missile you press the 'M' key. In learning the game, the focus is on the key and when to press it, but once the game is mastered the tool is the missile and the action is firing it. Pressing the 'M' key is in a perspective long ago abandoned. In this way different perspectives will have different means. They will overlap according to the way perspectives overlap, and some tools might be almost universal (e.g. hands, or their analogues). Some tools, on the other hand, might be available to only a few (e.g. experts or politicians) in which case the ordinary individual might only have persuasion in his toolkit in a particular perspective.

One possible view on making changes is to regard it as creation, destruction and rearrangement of elements as seen in the relevant perspective(s). Creation and destruction are themselves rearrangement; creation of something is assembly of its parts or removal of unwanted parts, and destruction of something is a more or less gentle dismantling of it. On this view, making changes consists of using the perspective's toolkit to rearrange elements, with appropriate attention to detail and often with unforeseen consequences in other perspectives. In another perspective, for example, that particular relationship between parts and whole might not exist, or be quite different. Creation in one perspective might be destruction or more or less meaningless rearrangement in another.

3.3.2 Theory and Experience

The other two aspects, Theory and Experience, have to be considered together in order better to separate them, because of their relation to interpretation and representation.

Theory gives experience a labelled grid, a set of distinctions and dimensions. The grid incorporates its own set of logical rules constraining manipulation of whatever finds itself in the grid's space. Theory can then formulate what is the case and what is to be done about it. The grid and its uses are taught, and are therefore to a great extent commonly shared - a prerequisite for communication.

It is often thought that theory is a framework for interpreting experience. At the beginning of his book, Hanson (1958) stresses that this is a misnomer. "Seeing as", he says, is not the same thing as "interpreting as". Kepler and Tycho do not simply see the same thing in the east at dawn and interpret it differently; they actually see different things because their conceptual organisation is different. Gregory disagrees:

> "Hanson, it seems to me, gives no good reason for separating interpreting from seeing. It is clear that the processes of seeing (including object recognition by computers, developed since Russ Hanson was writing) involve many processes which could well be described as 'interpreting' - though we are not aware of these or any processes of perception." (Gregory, 1981 p.388)

As usual, they are both right. These discussions seem to centre round ambiguous figures like the duck/rabbit or Necker cube and the question is: do we need to interpret the data before we can see it one way or the other, or do we just see it differently in the first place? Hanson recognises that interpretation is not a matter of placing a theory on otherwise neutral data, but of finding a perspective in which the data makes sense. He separated interpretation from seeing in order just to make this point. Gregory wishes to say that perceptions are like hypotheses of science, in that they are based on exist-

ing knowledge and rules of inference, but this looks very close indeed to Hanson's main point that observation is theory-laden.

If nothing else, we see from these arguments that the notion of 'interpretation' as we wish to use it in PR had better be clearly elucidated. It seems to be agreed that interpretation is not some kind of matching of theory to data once the perspective is settled upon, but rather a process of perspective choice. Much of the confusion probably arises from the converse of interpretation, namely representation. Representation, for us, will be simply concrete attempts at communication, and not some process in the mind or brain which somehow relates sense-data to knowledge. Representation is the means of pointing out a perspective space or saying what is going on in that space, and interpretation is what the recipient does to understand the message, namely to look where the message is pointing and thereby extract its meaning. If Nature is regarded as sending messages, this is best regarded as an analogy which should be used carefully.

3.3.2.1 Meaning

In the literature on cybernetics and AI there is frequent mention of "internal representations" of the world. These take the form of conceptual graphs (networks of linked concepts with rules for manipulation) and other syntactic templates which are compared with inputs and processed accordingly. Syntactic rules for manipulating sentences and techniques for matching patterns to templates can do no more than relate strings to other strings, albeit with impressive results. Meaning does not enter into it at all, if to 'understand' a concept is merely to put it in the right place in a hierarchy of types according to syntactic clues in the input definition. Searle (1980) is credited for pointing this out, but he was by no means the first.

For example Mackay (1969) points to a distinction, arising from philosophical and scientific work in this field, between structural and functional criteria of meaning - between the logical composition of a

message on the one hand, and what it does to the recipient on the other. Wittgenstein is one philosopher who embraced the former approach in the Tractatus and then shifted to the other approach in his later works while vigorously repudiating his previous position. Mackay points out, rightly, that the two approaches need not contradict each other.

The latter approach, the question of what a message does to the recipient, has proved more difficult to represent in usable form. Mackay suggests that meaning can be explained by the change it produces in the "state of conditional readiness for behaviour" in the recipient. This is close to Gilbert Ryle's notion of "dispositions to act" in a certain way (Ryle, 1949). The motive is to account for the behaviouristic observation that the same 'stimulus' means different things to different people, but without using a subjective terminology.

The state of readiness involves internal mechanisms as well as action and reaction, and encompasses the notion of readiness to perceive the world in a certain way. The discussion makes use of such concepts as the recipient's "internal representation of the world" and the "degrees of freedom" of such a representation.

In PR terms, we must understand these concepts practically. To say that an internal representation is a state of readiness to behave carries the suggestion that we live by a process analogous to string matching. The insight without that suggestion might read more like this: the internal representation of (an aspect of) the world is what you would say if someone asked you about it. At different times and in different situations you might give quite different honest answers to the same question, even if the situation is quite independent of the question. Often we can give an instant answer to a question we have never thought about before. Considerations such as this do seem to rule out internal, latent utterances just waiting for the right stimulus. The representation (the answer) is made up on the spot.

In certain forms of thinking, we do find ourselves unable to under-

stand something unless we can put it into words (or perhaps some other kind of representation), and so once something is understood there is also something to say about it. When we trigger someone's favourite hobby horse we do feel that we have evoked a disposition to behave. Answers to questions which are frequently asked, such as 'what do you do?', or teaching contexts, soon settle down to a pattern. But being ready with an answer before the question is asked is a very small part of our mental life, and in many areas it is the hallmark of a closed mind. Yet this is the model of thinking on which traditional AI is based, and the problems encountered are not those of meaning so much as the combinatorial explosion - the enormous range of syntactic templates which have to be included in a useful system of this kind.

To understand meaning, we would be better to consider the apparently spontaneous utterances, rather than these prepared speeches, because meaning must play a part in the former, and need not in the latter (hence the term "parrot-fashion"). It is the difference between discovering something and being told - for example, everybody knows that a rose carries thorns, and if asked about it would immediately say yes, of course. But the first encounter with a sharp thorn when removing overgrown weeds from the vicinity of a rose bush brings a quite new kind of knowledge, which is still expressed in the same way. It is as if one never knew it before. It is not a matter of a new "disposition to behave" in an evasive fashion towards thorns - that is a red herring, although a persuasive one because of the introduction of the notion of purpose. It is, for our purposes, simply a matter of having at last been at the point of view in the indicated perspective, instead of living on hearsay. Only then can the meaning be extracted from the statement and related to experience. So much of our knowledge is based on hearsay, and we can often go a long way just repeating and exchanging representations; but relating these representations to experience requires having been there, or somewhere relevantly similar.

Meaning, therefore, is not so much what the message does to the recipient but more a case of the reverse: what the recipient does with the

message, and what experiences he relates it to. Since the only way of ascertaining this is by eliciting further messages, it might have seemed that we are stuck here. We can do more, however, because unlike a message (which is ambiguous between perspective spaces), an experience is individuated by a perspective space and a point of view. A message which states these explicitly will wear its meaning on its sleeve and show precisely how to get there.

3.3.2.2 Relevance

In any given situation there are countless perspectives which are quite irrelevant to the purpose in hand. In ordinary situations we seldom even consider these, as we habitually settle on a perspective which we know is appropriate and relevant. This is one of the processes which the AI community has had great difficulty simulating, because it is still shrouded in mystery.

Sowa (1984) has given part of the answer, saying that we need a theory of conceptual relativity which takes account of the continuous as well as the discrete:

> "People make black and white distinctions when the world consists of a continuum of shadings. For many aspects of the world, a discrete set of concepts is adequate... . Yet such distinctions break down when pushed to extremes." (Sowa, 1984, p.344)

Sowa goes on to give examples of such breakdowns: the distinction between the body and the rest of the world is one, where doubt may arise as to the status of hair and nails (being non-living), hair dye and makeup, tooth fillings, tattoos and even clothes. In brief, all distinctions when applied to the world are vague in certain contexts and this, says Sowa, is a major problem in designing databases and natural language processors.

Perspective relativity can help to extend Sowa's answer. It is agreed that for many aspects of the world a discrete set of concepts is

adequate, but the same discrete set of concepts will not be adequate for all aspects of the world. A multiplicity of perspectives, with a set of rules for assessing their applicability and for moving among them would, if it could be implemented, dissolve many of these instances of vague distinctions. This would not be entirely a matter of different definitions of the same concept in the different perspectives in which it is found, although this might be a part of the implementation; it is, more centrally, a matter of inclusion or omission of distinctions according to their relevance.

In the example of the distinction between a person's body and its surroundings, such alternative distinctions might include:

a) anything that a normal, healthy body always carries with it vs. anything else, which would allow hair and nails but not tooth fillings, kidney stones or cancers;

b) anything that is a factor in the space that a person occupies vs. anything that is not, which allows fingernails, hair, clothes, briefcases etc. but not hair dye or tooth fillings; or

c) anything that is not easily removable vs. anything which is, which allows tooth fillings, permanent hair dye, artificial hips and cancers but not clothes, makeup, 'fun' hair dye or dentures.

With any of these, there will still be borderline cases, but the fact that these are not hard-and-fast definitions is part of the point we are trying to make. There is a place for definitions, and this is not it. This is a matter of looking at the world and juggling with perceived borderlines (according to already-learned distinctions) and eliminating all the irrelevant ones until all and only those which are relevant are included.

The outcome of such an elimination process might still include more than one perspective, because relevant-seeming distinctions might cross one another as they did in the example above, precluding integ-

ration into one perspective space. Then, depending on the original problem, the system might offer a menu and request further clarification, or alternatively choose the first one and proceed.

With such strategies as these, PR could provide additional tools for setting up and updating a database. For example, two common problems encountered in information storage and retrieval are the problem of 'out of sight, out of mind' and the problem of 'what you put in and what you leave out' of a particular category (see Sharp, 1965, for an elucidation of this traditional problem). Obviously the items that do fit neatly under existing headings are best left alone, as they will be retrieved easily enough when needed. The problem occurs when string matching by keywords, on which information retrieval systems work, is inadequate. A useful system might help to ensure that a new item will be placed where it will be seen when it is needed, but preferably not at other times. Such items are best related to situations, or rather, to perspective spaces, rather than to keyword headings.

There are two approaches to finding a perspective space, which correspond roughly to Mackay's selective information and descriptive information respectively. Selective information is

> "...that which enables us to make a *selection* from a set of possibilities or to *narrow the range* of possibilities about which we are ignorant." (Mackay, 1969, p.11)

Descriptive information, by contrast, is what we look for when

> "...our problem is not to select but to *build* a picture. ... Our first problem here is to transform our experience into a symbolic picture or description of what we believe to be the case. Our picture...depends for its every feature on our actual observations. Each element in the picture therefore formally represents and has its origin in one corresponding elementary feature of the experience pictured." (Mackay, 1969, pp12-13)

These two senses of 'information' give rise to two ways of delineating a perspective: 'elimination' and 'construction'. The elimination approach starts with a large store of possible perspectives, and every new element in the problem as it is put to the system eliminates a portion of them as irrelevant. The construction approach, by contrast, builds up a perspective space on the clues provided by the problem as put. Both are necessary and important; elimination alone does not provide for new perspectives to be added to the store as appropriate, and construction alone will be constantly re-inventing wheels and not allow full advantage to be taken of the large store of Knowledge which must play such a crucial role in AI systems.

The relevance of a perspective space to a situation obviously depends on what is required from it, i.e. whatever purpose is being brought to it. We shall be considering purposes in section 3.4; first let us summarise the relationships among the three aspects we have distinguished. The discussion will also introduce perspective jumps, which are discontinuous shifts between distinct perspective spaces, and are intimately related to purposes. At this point we do not need to consider how they occur, but only when they occur in terms of what is happening in theory, experience and practice.

3.3.3 Aspect relationships and constraints

Fig 3.1 overleaf is a diagram summarising the relationships among the three aspects. The aspects are represented by three circles, spaced around a fourth which represents perspective jumps. The arrows (a) to (f) towards and away from the jump represent transitions out of and into a particular perspective space. The curved arrows between the three aspects represent constraints and limitations, not transitions or any kind of sequence since in any particular perspective at any particular moment all the aspects are involved.

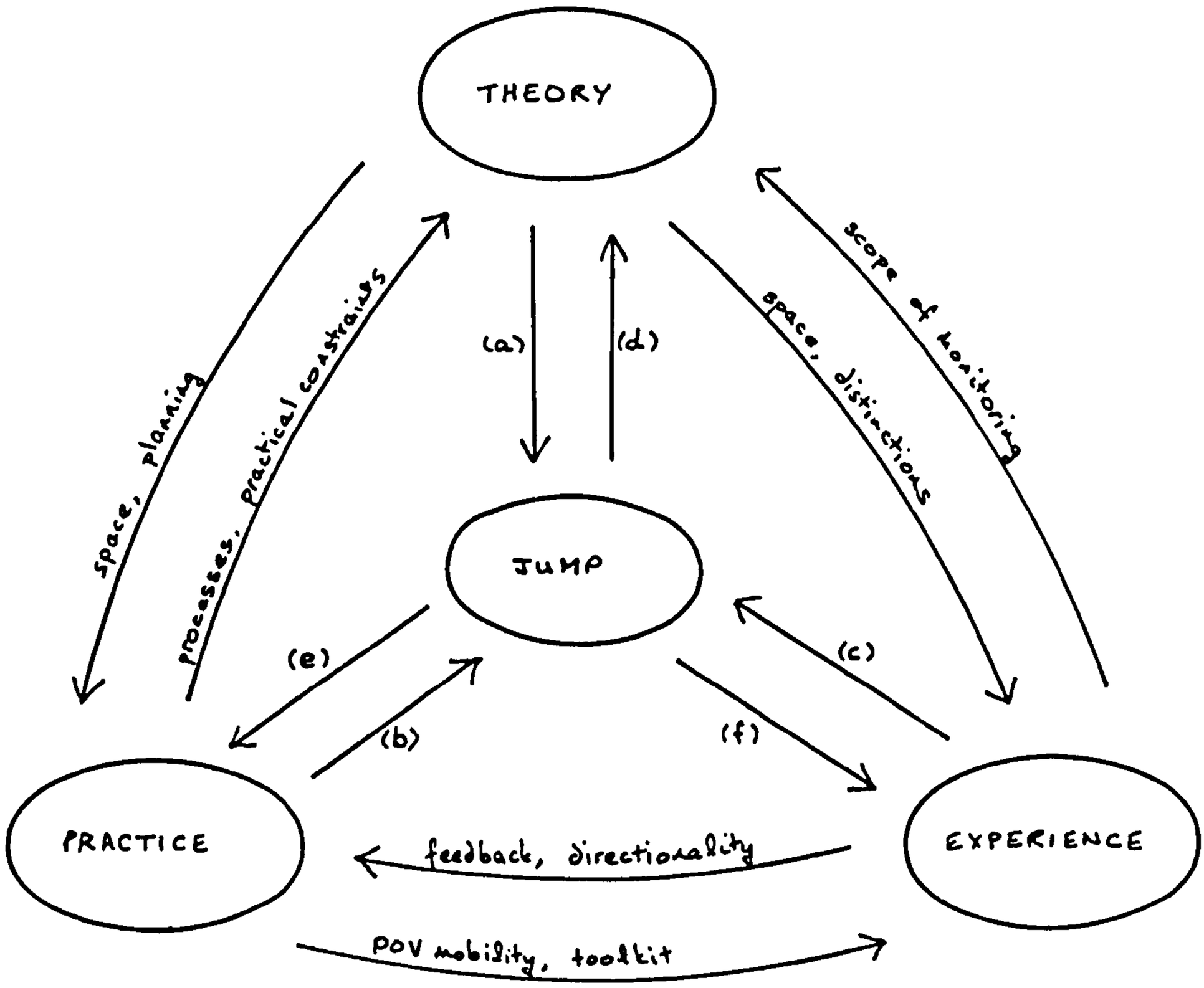


Fig 3.1

While relatively independent, in the sense that certain features of each aspect are peculiar to that aspect, still the limits of one can put constraints on the others. Since there would seem to be what might, after Ryle, be called a "category difference" (Ryle, 1949) between any two of the aspects, it might at first sight appear that it is a category mistake to regard one aspect as constraining another. But thanks to Hanson, Kuhn and others we are quite familiar with the notion that theory constrains practice and experience, and that practical difficulties constrain acceptable theoretical formulations. Finally, experience provides the possibility of falsification of the theory, and demonstrates the appropriateness or inappropriateness of an articulation of a paradigm as applied to that particular piece of the world.

The constraints are summarised as follows:

> Theory is limited in its understanding of processes and in practical possibilities by Practice, and also by the scope of the monitoring provided by Being There;
>
> Practice depends on Theory for the space in which the movement occurs, and for planning, and depends on Being There for feedback and directionality;
>
> Being There also is limited for the nature and scope of its space by Theory (including the discriminations it allows for), and for the toolkit and point of view mobility by the practical aspect.

If any of these limitations of the present perspective make the goal unattainable, then a perspective shift is called for. In the diagram, the arrows towards the 'jump' reflect this as follows:

(a)Theory: finds the goal theoretically impossible, or cannot formulate the problem precisely enough, or finds the goal in conflict with other goals (e.g. too dangerous);

(b)Practice: finds the goal impracticable for any reason, e.g. insuperable obstacles, paralysis etc.;

(c)Being there: finds the view obscure, or obscured, or finds emotional obstacles (e.g. boredom, fear) or suffers sensory malfunction, etc.

The arrows away from the 'jump' towards the other three reflect a shift into a perspective considered, stumbled upon or seen to be appropriate to the passing show (to borrow a phrase from Quine). Attention may be drawn by a phenomenon in experience, or by a representation in Theory. In either case the other aspects are also involved as soon as the shift is made. The practical aspect also provides an entrance to a new perspective, for example through prac-

tice of a skill. Referring back to the diagram, then, the ways into a new perspective are:

(d) a representation of some kind, e.g. a description, statement, drawing etc. enters the field (learning), or
a question is asked (teaching), or
instructions are received for reasons which are understood in the new perspective;

(e) compulsory action (e.g. being pushed), or
practice in a skill or technique, physical or mental;

(f) something, either unusual or urgent, is suddenly noticed (the urgency etc is part of the experience), or
something quite incomprehensible in any hitherto known perspective is nonetheless noticed, often with a sense of revelation.

We must be careful when trying to distinguish among the three aspects since, for example, Practice in one perspective might be Being there in another perspective: an action towards a goal might be someone else's entertainment. Similarly, a Theoretical representation of one perspective might be lines on paper, sound waves or whatever, in another's Experience. We cannot look at a portion of the world and say: this is Theory, that is Practical, etc. We must also be clear as to the distinction between the perspective we are in and the perspective we are talking about.

3.4 Perspective shifts, values and purposes

Having identified the perspective, we then look for the goal, if there is one. Let us therefore move at this point to consideration of purpose, and its intimate relation to changes in perspective. The goal is a state of experience, and is by implication different from the present state of experience (or the projected future state). We have assumed that Experience is essentially passive, that is, it is the

outcome of a certain way of setting up Theory and Practice and doesn't do anything in the physical world of itself. It is just the *way* things are (seen, remembered, imagined) in the perspective. (Again, it is important to stress that this strategy is not the only one. If it is found, somehow, that a perspective's being experienced does *ipso facto* change the world, then the strategy can be altered accordingly. Psychology experiments, where the subject is not told what is going on, are a possible case in point. The limit to observation in Heisenberg's Indeterminacy principle is another. But in these cases, great care must be taken that we are looking in the right space.) We have seen, however, that Experience does put constraints on Theory and Practice where we generally have the feeling that things are done.

A goal, then, is basically in the Experience aspect; nevertheless it is the representation of it which provides the basis for a search for solutions, and the toolkit which provides the means.

Some 'goals' can be translated into rules, such as Kant's categorical imperative or the various rules of thumb used by designers and architects. These rules provide tools for those who don't have the knack of doing it right without them. They are actually incorporated in the perspective space as dimensions of desirability, since the terms in which the state of affairs in the perspective space are described are the same terms used to indicate which of the possible states of affairs are the more desirable in that perspective.

Purposes which can be treated in this way we can call "values", after common usage. Like the other distinctions and dimensions in the space, they affect the way of looking at the world as it is. A space with different values is not the same space.

Intentions, by contrast, do not lend themselves to this treatment. They may arise from, or be circumscribed by, values in the spaces their implementation might affect, but they are not built-in to the spaces in the way that values are. Generally, "purpose" refers to intentions, or problems, rather than values. Purposes are desired

results, rather than merely comments.

Purposes are therefore intimately bound up with the appropriateness judgment, and with shifts in perspective.

We can identify several different types of perspective shift. The simplest type would be a movement of the point of view, for instance standing on a chair to see over a wall. The perspective is settled upon; the only problem is the practical one of a wall obstructing the view. This shift does not involve a jump between two different perspective spaces.

If no chair had been readily available, a jump to a new perspective with the purpose of finding something to stand on might be the next step. If nothing suitable can be found, the project might be abandoned in favour of some other goal, e.g. continuing on one's way. Alternatively, something else might catch the attention - a rare butterfly, or an approaching car. Then again, a more dramatic perspective shift might occur, as in successful "lateral thinking" (de Bono, 1967), whereby some quite different solution to the problem is suddenly seen. Here, old ground is looked at in a new way (we also say: in a new light). De Bono offers methods for cultivating and encouraging such shifts in one's business and social life, and his suggestions include generation of alternative ways of looking and suspension of judgment so as not to dismiss an idea prematurely.

Some perspective jumps make the old perspective obsolete. Kuhn's 'revolutions' are jumps of this kind, but the concept encompasses more than those perspective spaces which occur in science. Revolutions in science do not happen every day, but ordinary insights, which often have the same quality of discontinuity and can supersede old ways of looking, are quite frequent.

All these types of shift happen all the time in everyday life, and the purpose and toolkit are clearly intimately involved in motivating

them. Sometimes a shift is prompted by an unsolved puzzle within a perspective, sometimes it comes about by the new one calling in some way - perhaps a question is asked, or something is noticed. Generally the new perspective is judged more appropriate than the old one in some way or another - otherwise there would be no point in adopting it.

3.4.1 Appropriateness and perspective jumps

Good and bad, high and low, comfortable and painful, are relative to particular perspectives. Appropriateness to the present situation, however, is a different matter. Appropriateness is relative, but it is relative to something more immediate and dynamic than a particular envisaged goal. The goal itself might be inappropriate. Appropriateness seems to relate to the state of the world as it is in itself, so to speak.

This is a generalisation of the problem of theory-choice which has led to so much misunderstanding of Kuhn. Because the choice of perspective must come from outside the perspectives themselves, there can be no hard criteria unless there is an all-embracing 'absolute' perspective from which to judge the others. One of the most persistent quests in philosophy is to look for the most basic and comprehensive perspective, or meta-perspective, with a view to seeing the whole world within it. An example might be the Taoist Yin-Yang theory. But such a rarified God's-eye view is seldom of much use, because it is bound to be ambiguous when applied to detailed problems (e.g. moral dilemmas, or sorting foods into yin and yang). With specific problems, an all-embracing perspective is so much excess baggage.

This is not to say that perspectives on perspectives are of no use in an appropriateness judgment. It may be that values in such meta-perspectives, with their associated rules, can provide something like a calculus for the judgment. Such values, in the case of paradigm choice in science, might include simplicity, scope, predictive value and relevance. In more practical areas, whether it be an ordinary

switch of attention, the adoption of a new paradigm in science, a new way of looking at an old practical problem, or the best place to look for, or store, something in a database, the values might include efficiency, convenience and so on. Compatibility with values in other affected perspective spaces is also fundamental to perspective choice.

Another question to consider is whether in any given situation there is just one appropriate perspective. Hunches point both ways: from time to time we all have the experience that something is 'exactly right'; on the other hand we often see the same problem solved in different ways, all equally effective. This is another example of a case where the strategy can go either way according to taste (i.e. other PR theories might choose differently).

One consideration, following Feyerabend, is that there are numerous advantages in a strategy of exploring as many different perspectives as possible, with an air of flippancy. It is the closest approximation to an absolute perspective, and the best way to look at the world without missing the obvious; it not only helps us to understand other people, but also actually helps us to understand the world. The idea that we cannot communicate unless we have a single universal perspective does not follow from the notion that perspectives must be matched for communication to take place - on the contrary, it is more effective to learn how to see the world in more different perspectives. A lighter touch is suggested, bringing with it a sense of economy and efficiency.

In any case, if there were only one appropriate perspective (that of a saint or sage, for example) we could never arrive at it by rules and searches because there might always be alternative meta-perspectives, possibly arbitrated by a still higher one, leading to an infinite search - to say nothing of the enormous scope on the original level. So we shall consider appropriateness to be a matter of degree: 'if it'll do, it'll have to do'.

We have seen that, at least in everyday life, shifts are the rule

rather than the exception; but theory, practice and being there do not alone provide us with a clear way to jump between two quite distinct perspective spaces. They do provide ways into their own perspective, but not ways out of a current unsatisfactory one.

In order to judge one perspective to be more appropriate than another, one at least must be able to see them both (though not necessarily both at once). Argument in favour of a certain perspective jump is not enough to bring it about. However well I understand an argument or description of an outlook, I cannot make the shift on the basis of that alone, even if I wanted to. I must be shown (being there) what it is like, and I must take any necessary practical steps before any jump can take place. In short, I must be ready for the shift with regard to all three aspects. In the case of a revolution a considerable amount of groundwork may be necessary first (possibly in the unconscious, for perspectives whose ontologies have that notion).

A very useful project, therefore, would be to elucidate the groundwork necessary for a jump to an unfamiliar perspective. The new perspective might have to develop gradually, by stages or insights. Good educators are probably the best qualified to comment on this.

In the case of already familiar situations, the groundwork was done long ago. The difference between a jump to a familiar perspective space and a jump to an unfamiliar one is only that in the latter case the jump is being made for the first time. Most discontinuous perspective jumps are between familiar but incompatible perspectives - incompatible only in the sense that they cannot both be viewed at the same time. There is a large store of perspective spaces already available to a person (Gregory terms this "Potential Intelligence"), and it is from these that a perspective is normally chosen in a given situation. The Experience aspect, so far the most mysterious, plays as crucial a part in this choice as the other two.

If there is a way to make the judgment by searching or matching, it will have to come from a meta-perspective; otherwise there is nothing

but noise to match with. The appropriateness judgment seems quite spontaneous to us most of the time; to make a set of rules for it must be a matter of perspective on perspectives, where appropriateness can be a value. In setting up such a system, however, this value is likely to be arbitrary, since other meta-perspectives might see it differently.

3.4.2 Further remarks on purposes

In cases where there is no ideal involved, a representation in Theory is a plain description of what is going on in the perspective as in, for example, (ideal) scientific and police reports. Usually we find some value judgment either explicit or implicit in expressions of Theory. (An immediate example is the suggestion that an ideal report should have no ideals built-in to its particular perspective space).

Where there is a relatively clear purpose, there will be a definite difference between the present (or, alternatively, envisaged future) state of affairs and the envisaged goal. Where a clear purpose is being pursued, there is no call for a perspective jump; by that stage the perspective space has been settled upon. If, however, while the goal is being pursued it turns out to be impossible either theoretically or practically, or not so desirable after all, then a perspective jump is called for.

If in the course of pursuing a goal there is an interruption which brings about a perspective shift, there might be two goals in two different perspectives which somehow have to be compared for priority. The dilemma would be resolved either by finding a perspective which allows achievement of both goals or an acceptable compromise, or by abandoning one goal in favour of the other, or by abandoning both if a jump produces a perspective in which they both seem silly. A shift to a meta-perspective may or may not be of use.

3.4.3 Vague and negative purposes

So far we have mainly considered clear, positive purposes. Many goals, however, are only vaguely understood, or negative (where any relevant change will do), or both.

A clear, negative goal (expressible usually as 'x is too y' - for example, 'I am too cold') would be achieved either by any movement on the relevant dimension in the current perspective (in the example any currently practicable steps to warm up), or by shifting to another perspective where things don't seem quite so bad (in the example, perhaps regarding it as an exercise in hardiness). In both strategies the purpose is easily converted to a positive one, because it is clear and the relevant dimension is therefore isolated.

A vaguely understood goal may be negative or positive. At that stage, there is only an area of disquiet in the perspective, with no clear formulation or visualisation of it. If it is negative, the goal is escape but it is not yet clear from what. If it is positive, the goal is some change, but it is not yet clear to what. In both cases, the perspective requires further clarification before an efficient course of action can be sought. A negative, vague purpose, such as 'I am unhappy', is best clarified first before converting to positive; what is required is to find out what one is unhappy about, whether it is job prospects, home life or whatever.

3.5 Communication

We now have the beginnings of a view of communication which, true to the nature of the subject, is easy to understand. Cherry (1978) stresses that communication is essentially sharing, and points out that certain things, such as emotions and the sense of "being" cannot be shared. Cherry's idea of sharing seems to be based on the observation that a message is not lost to the sender. Coupled with this is a valuable discussion of the social nature of language and its analogy with morals.

In considering perspective relativity, however, when we say that a perspective must be shared for communication to take place, we are taking Cherry's point a stage further. Communicators share not only a common language and customs, but must also share a way of seeing the relevant world. The failure of attempts by philosophers to put this way of seeing in a comprehensive framework which relates it to language seems to suggest that this 'way of seeing' incorporates a multiplicity of perspectives.

In fact the multiplicity of perspectives is so enormous that most communication between two people is only partial. Not only must all the relevant distinctions be understood but also, as we saw in the example of the rose, they must be appreciated in the same way. An extreme view would be to say that perfect communication is impossible because no two people share the same experiences and even if they did, since experience is essentially private they would have no way to ascertain that they did.

We have seen that a particular experience is not individuated by a sentence, even if the definitions of the words are made plain, but that it can be individuated by a perspective space and a point of view. It will not do simply to give spatial co-ordinates and a direction, because this does not give the whole perspective space; what is needed is a clear way of pointing to all the distinctions and dimensions which go to make up the space in question.

In order to work with this idea, we need a sufficiently precise and at the same time comprehensive notion of what a perspective is. The perspective on perspectives outlined so far (by no means the only possible one) includes the practical and experiential aspects as well as the theoretical space.

The analysis of these three aspects of a perspective can make it easier to talk about conscious activity (and unconscious activity) without making any commitment as to what consciousness 'actually' is, what truth is, what feelings are and so on, in the real world. Be-

cause of this tolerance the theory of perspective relativity is not intended to be a philosophical position - it was here that McGilvary's perspective realism came to grief - but it does provide us with an approach to problems like the one with which this project began, namely, that of finding a useful way of manipulating meanings where syntactic rules are not enough.

Perspective shifts, of all kinds, are the rule rather than the exception and depend on the purpose brought to the situation and on the values inherent in the perspectives concerned. Other notions, such as appropriateness (of a perspective to a situation) and relevance (of a perspective to a purpose), are intimately bound up with shifts and purposes.

These and other related concepts require further clarification, which will be attempted in chapter 4. Then in chapter 5 we shall look at some possible areas of application.

CHAPTER FOUR : PERSPECTIVE RELATIVITY

Contents: Page

4.0 Introduction

In the last chapter we considered the versatility of perspectives as a conceptual tool, and the relationships among certain aspects of a perspective. Useful concepts in perspective relativity, some of which we have already touched upon, include: differences and combinations of perspectives, mutual relevance, co-operation of two or more perspectives, incompatible perspectives, the effect of values and goals, and the possibility or impossibility of an 'impartial' perspective (God's-eye view). These matters can be more easily discussed if we have a clearer terminology with which to work, because while the concepts are relatively simple their interaction can become very convoluted. In this chapter, therefore, we shall be looking at a possible example of such a terminology. This chapter is physically shorter than the others, but arguably the most important. Because of the way the concepts are introduced, the format is slightly different; the numbered subdivisions do not have separate headings, and where a concept appears for the first time it is printed in boldface.

*

4.1 A perspective is determined by two elements, namely, a **point of view (POV)** and a **field of view.**

4.1.1 The POV is an abstraction; it is a point in a space, not an object (though it might be occupied by an object, e.g. an eye or a probe), and it has no qualities of its own.

4.1.1.1 When we speak of 'the point of view of science' or 'the point of view of Londoners', for instance, we generally mean the field and not the POV. The POV is just what draughtsmen call the station point; it has no qualities or attributes other than its position in relation to the field.

4.1.2 The field of view is whatever is before the POV in that perspec-

tive - whatever is being looked at.

4.1.2.1 The position of the POV does not alone determine which field is in view; for example, the field in a drawing of a still life could be the marks on the paper, or the objects depicted, or the space in which the objects are situated, or certain facts about the objects, such as their relations to one another and to the POV. We can shift from one to another of these perspectives without moving a muscle. We can even pick up a complex value-laden message from the artist, if we are in the perspective he had in mind. Anything that could conceivably be looked at from any POV is a field of view.

4.1.2.2 We must keep in mind that the field is not the representation of the field - although it might happen to be a representation of another field.

4.1.2.3 A field can be expressed, in the Theory aspect, in any of the different ways that people communicate with one another using shared signs and symbols. Theory is not restricted to written and spoken language, whether natural, formal or specialised, but also includes diagrams, artistic creations in any medium, facial expression and gesture. Each perspective is conducive to some such form of expression in the Theory aspect, even though the message might only be available to those already familiar with the perspective.

4.1.2.4 We have referred elsewhere to Theory as putting Experience on a labelled grid. The form of the grid is quite variable. We could choose one form to express all fields, provided we remember that we imposed rather than discovered that constraint. For example, we could choose to regard all fields as made up of 'holons', after Koestler (Koestler, 1978), with emphasis on wholehood and parthood; or we could choose that all fields are composed of elements with boundaries, attributes and relations to one another. This kind of choice is a matter of convenience of handling.

4.1.2.5 Given that there are alternative ways of expressing the same

field, we must beware of the distinction between perspectives on perspectives and perspectives on the world. A different perspective on a particular view might involve a different mode of representation, but it is still the same view. By contrast, a switch to a different perspective space, even if the person, or probe, does not move at all, is a switch to a different view which may or may not involve a different form of representation.

4.1.2.5.1 For example, marks on paper might be represented by patches of light and dark, or by boundaries between light and dark patches, but they are still marks on paper; the difference is one of perspective on the perspective. If the marks are seen as depicting objects, however, the space, and the view, have changed to that of the objects and the switch is one of perspective on the world.

4.1.2.6 Having separated perspectives on perspectives from perspectives on the world, there is one more item of structure to point out. We have said that the perspective space is a set of distinctions and dimensions upon which ontologically accepted elements find their place. What is the difference between distinctions and dimensions? At the early stages of the project they were regarded as practically the same thing, but it turns out to be useful to separate them. Dimensions are divided into units, and can be the axes of graphs, whereas distinctions are yes/no affairs. Distinctions are nonetheless part of the space; a perspective space with the same dimensions as another but with different distinctions, especially distinctions which cross those of the other, is a different space offering different views. Rank orderings, like hardness, could be treated as distinctions or as dimensions according to the purpose. So could colour, for example, being an ordered spectrum from red to violet, or mixtures of primary colours, or a menu of just a few.

4.2 First let us consider **how the POV relates to the field** The question is: is it more useful to regard the POV as a point in the field's space, or as a point on a dimension orthogonal to it?

4.2.1 Consider the experience of looking at one's surroundings in the perspective of, say, three-dimensional physical objects in space. The POV is somewhere in that same space, and has the same kind of relation to the objects as they have to one another.

Now consider the same situation, but in the perspective of, say, colour patches in the visual field which is two-dimensionsal. Here the POV cannot be in the field space. What is the difference between these two perspectives, whereby in one the field encompasses the POV and in the other the field not only does not but cannot encompass the POV?

4.2.1.1 We must bear in mind that a POV cannot look at itself (although another POV might look at it) and so if the POV is located in the field it must itself be a 'blind spot'. This might be awkward, as the POV would have to alter the space around it in some way.

It seems preferable to regard the POV as something which is perfectly simple and which does not, by being occupied, alter the field's space in any way. Therefore we would like to say that the POV is not a point in the field, yet in the world of everyday objects it obviously is in the field's space. How do we solve this dilemma?

4.2.2 We can solve it by making a distinction between on the one hand the **view**, and on the other hand the **field space**, or **perspective space.**

4.2.2.1 Then we can say that the POV for each view is located in the field space which encompasses or embeds that view and others, but is not and cannot be located within its own view. The field space therefore has one dimension more than the views have.

4.2.2.2 This field space is also a view, from a POV which is a point in a still higher-dimensional field space. Thus there are perspectives on perspectives. Conversely, we can say that any point P in an n-dimensional space is a potential POV for any (n-1)-dimensional fragment of that space which does not include P itself.

4.2.2.2.1 The physical objects around us, then, can look three-dimensional because imagination and memory of other views enables those views to cooperate with the present one. All the individual views on the objects are two-dimensional, 'camera' views (although it takes an effort to see them as such possibly because of genetic factors).

4.2.2.2.2 The 'mind's eye' is able to see physical objects at various distances and orientations because of cooperation among different (imagined) views on them. The mind's eye is also a POV, but it does not correspond to any particular view on the objects. Its view (the **overall view**) is the field space of the camera views, and the POV of this view is therefore outside that field space (a clue to the mind-body problem?). We could define the overall view of a space as the views from all the points in that space combined.

4.3 To **combine two perspectives**, (i.e. in order to view both at once) we must find a space which embeds both their field spaces.

4.3.1 If they are already the same, or one already embeds the other, this is easy.

4.3.2 If they overlap - that is, they have at least one dimension in common - then we can (at least in theory) hook them together; if the resulting space contains distinctions which cross one another, all but one in each knot can be dropped.

4.3.3 If they do not overlap, we can look for a space which overlaps both - again, eliminating crossed distinctions.

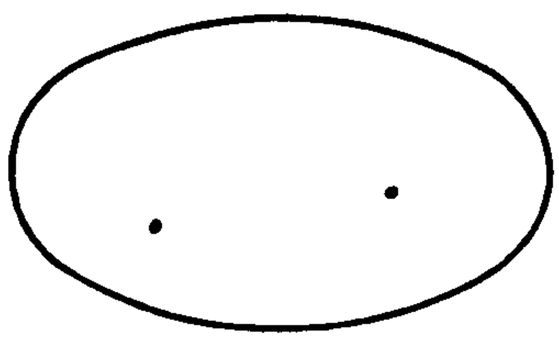
4.3.4 If it should prove impossible either to find a common space or find a common distinction, then the two perspectives will remain forever separate and "incommensurable".

The possibility of combining perspectives thus depends on perspective differences.

4.4 We can split **perspective differences** into three categories:

A) different POV, same field space
B) different field space, same POV
C) different POV, different field space

4.4.1 The first of these categories is potentially the most congenial, since two POVs on the same field space can serve to enrich each other's overall view i.e. makes possible a wider perspective which encompasses both, and in which the view is their field space. Let us illustrate this category by fig 4.1a:

fig 4.1a  Category A

where the circle represents the field space and the dots the POVs. One example might be binocular vision, where two very similar 2-D views result in a sense of depth. Another example is friendship, where an area of expertise or interest is shared. The different POVs make available different facts which can immediately be communicated to the other because of the common perspective space. The spirit of the interaction is one of cooperation.

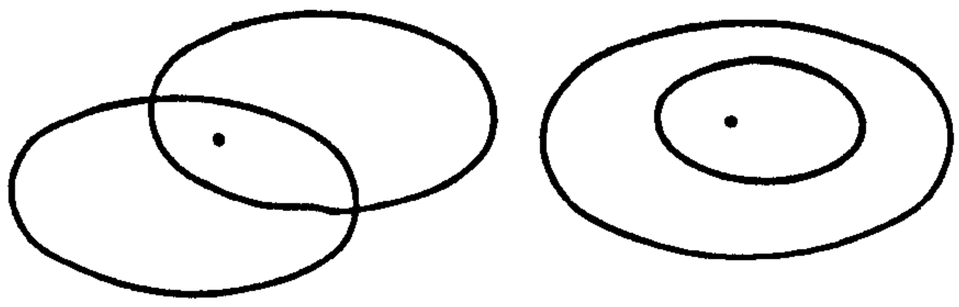
4.4.1.1 Having said this, we often refer to quite acrimonious argument as a difference in point of view. The facts, it might be said, are agreed upon; the difference is in the values placed upon the facts. For example, suppose it is agreed that the level of unemployment is too high and that something must be done about it. The statistics are agreed upon, and so (let us assume) is the awareness of the individual human misery it causes. Yet the government and the opposition are never seen to cooperate to solve the problem. New facts brought to light by one side do nothing to enrich the other side's view. The facts are already shared.

In such a case it is not the perspective space that is shared, because the agreed facts have different implications for the two sides. What is at issue is the other factors considered relevant and important in considering the agreed problem. Therefore the two sides have different extensions to the space in which the problem is stated, over and above the distinctions and dimensions they have in common.

4.4.2 This political problem is an example of the second category of perspective difference, where the POV is shared but the views are in different field spaces.

4.4.2.1 This amounts to saying that the same piece of the world is different in the two perspectives.

4.4.2.2 This second category of perspective difference may be illustrated by the diagrams in fig 4.1b:

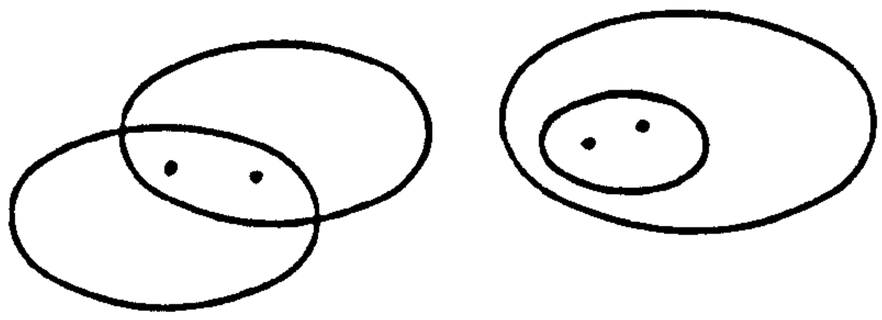
fig 4.1b  Category B

To have the same POV, the field spaces must overlap or 'hook together' on at least one dimension; the most obvious example would be spatial position, but we must remember that many perspectives do not include those dimensions. (If the field spaces have no dimension in common, then there is no sense in which the POV can be the same in both.) The common POV must be within the intersection of the field spaces (that is, the space consisting of the dimensions they both have in common).

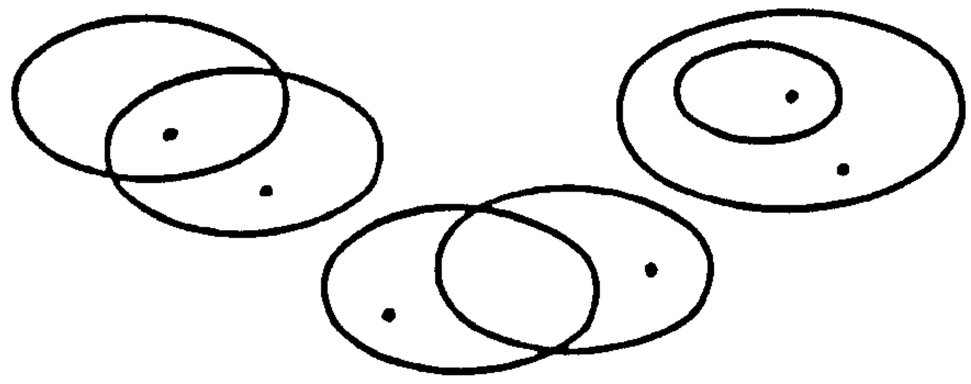
4.4.2.3 Another example of category B is learning and teaching, where the perspective space to which the pupil has access is still developing towards that of the teacher. The spirit is one of persuasion, to enlarge the other's field space. In the political example above, the persuasion is two-way.

4.4.3 Now, what of category C, where the POVs and the field spaces are both different? There are three different ways this could be:

Ci) the field spaces overlap, and both POVs are within the intersection;



Cii) the field spaces overlap, but one or both POVs is not in the intersection;



Ciii) the field spaces do not overlap at all.

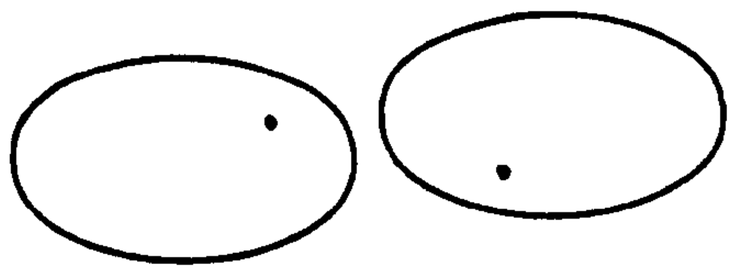


fig 4.1c Category C

4.4.3.1 Case Ci) reduces to category A in the intersection of the two field spaces (i.e. same field, different POVs), so provided that that limitation is understood, cooperation can flourish. Similarly, with judicious operation of the toolkit (i.e. movement of the POV within the field space) in one or both perspectives, Cii) can be converted to category A. Alternatively, Ci) and Cii) can be converted to category B by moving the POVs to coincide in the overlap, and communication in the spirit of persuasion can begin.

4.4.3.3 Not so with Ciii), the extreme case of category C. There is no facility within the perspectives themselves to bridge the gap between them. Communication is impossible, since nothing is shared, and so to go from one to the other requires a perspective jump.

There is no room even for antagonism between the two perspectives. This is the situation Whorf points to when he discusses the different

classifications apparently to be found in the Hopi tongue as compared with those that we take for granted (Whorf, 1956). It occurs, usually on a much smaller scale, when people talk at cross-purposes. Again, the duck/rabbit drawing is an example of this category, since the one excludes the other. Similarly, the duck and the rabbit both exclude the marks on the paper. Such pairs of perspectives are **incompatible** or "**incommensurable**", and they are to be found everywhere.

4.4.4 We can define **coherence** of a perspective as follows: a coherent perspective is one which is not made up of one or more incompatible perspectives. Where two incompatible perspectives are confused, the result is a perspective which is incoherent.

4.4.4.1 Two perspectives are compatible if one can be added to the other without the need for a perspective jump. In other words, they are compatible *except* where the difference is of category Ciii.

4.4.4.1.1 For example, colour can be laid on top of shape, but the Mona Lisa's eyes and hair are in a different space, a space 'inside' (or 'behind') the picture wherever it goes, and whenever it is reproduced. This reflects Ryle's notion of a "category mistake" (Ryle, 1949). The spaces are mutually exclusive (a category Ciii perspective difference) with the added problem that they are not seen to be different, and so it seems as though the POV is shared.

Thus some philosophers feel that the Mona Lisa's smile must be found in, or defined in terms of, a configuration of light and dark patches. Similarly, when puzzling about the nature of communication we feel that the message must be contained in the signal in some way, that the sender's intention is to be found in the message, and so on.

If whatever you are looking for is not immediately apparent, then a perspective shift is called for, however clear the present perspective happens to be.

4.5 Given these different forms of perspective difference, **perspective shifts** can be classified similarly.

4.5.1 The simplest shift is just movement of the POV in the perspective space, e.g. to get a better view. This corresponds to a Category A perspective difference, where the perspectives are just two different views in the same space. The two perspectives are obviously compatible and in practice actually enhance each other.

4.5.2 A shift between a category B pair of perspectives, where the POV is the same in both, will be a matter of addition or subtraction of dimensions and distinctions. A new distinction might be pointed out, and added to the view, or a dimension might be dropped because of irrelevance. The facts themselves are unaltered; it is a matter of which facts are considered relevant.

4.5.3 Category Ci and Cii are variations on categories A and B. Again the perspective shifts corresponding to them could be broken down into a relatively smooth slide from one to the other: adding a dimension here, removing one there, sliding the POV over there, and so on.

4.5.4 Shifts between incompatible perspectives, by contrast, cannot be analysed in this fashion. There is a definite quality of discontinuity in the shift.

4.6 **What of the world?** We tend not to see what we don't expect to see. This does not entail that reality is 'merely' subjective, like the tree in the quad. There are, we may assume, countless perspectives which have never been and never will be actually experienced.

4.6.1 In this sense the world consists of perspectives - not of photons and quarks, or animals, vegetables and minerals, but of all possible distinctions which make up ways of looking.

4.6.1.1 In another sense the world is made up of animal, vegetable and

mineral, or of the natural and the artificial, or of atoms, or whatever you will. These are all equally fundamental ontologies, each in its own perspective (or set of perspectives).

4.6.1.2 If a coherent perspective space contains a distinction, then it should be safe to say that the difference corresponding to that distinction exists in the world. If a distinction appears only as a result of a confusion of two incompatible perspectives then it may be that there is no such difference in the world, only in the way of looking. Our original problem, that of the relation between signal and message, might find its answer here: that they cannot cohabit the same space.

4.6.2 Provided the space is not mistaken for another, a coherent perspective is not mistaken about what is in view. We have also reason to assume, as Sowa pointed out, that there are incompatible perspectives which are nonetheless coherent within themselves. It follows that there is no single perspective space which includes all aspects of the world.

4.6.2.1 The structure of a field space will, if it is overworked, eventually produce generalisations which go beyond the scope of the original view. This is what happens when a paradigm in science is found to be increasingly unsatisfactory as the analogy is pushed too far. We saw in Chapter 2 that it is the crudest, most limited analogy which makes the most effective scientific paradigm. Just as any mistake about what is in view is in the choice of space, the limits to a particular space are in its scope of appropriateness.

4.7 Since any view depends on a particular perspective space, it must incorporate **assumptions**, which may or may not be explicitly understood.

4.7.1 If we can relate these assumptions to the perspective space we can use the relation both ways. That is, we can use explicit assump-

tions to delineate the space, and we can use the space to point to implicit assumptions. In the first case, the user can tell the system which space to look at, and in the second, the system can help the user to clarify any ambiguities. Implicit assumptions are the sort of statement which a person might not formulate for himself but which, once formulated for him, he can at once recognise - as in 'I couldn't have put it better myself'.

4.7.2 Not all assumptions are about the perspective space. Hypotheses, for instance, are usually not about the space but about what goes on there. Hypotheses, comments and factual statements do not contribute directly to the space delineation, but aspects of the space can be inferred from the concepts expressed in such statements.

4.7.2.1 A concept might find a place in several quite incompatible perspective spaces, so the mere mention of a concept is not enough. We said in Chapter 1 that any statement partitions perspectives into three classes: those in which the statement is true, those in which it is false and those in which it does not make any sense or is irrelevant. This partitioning could give rise to a useful technique, since all but the first class can then be immediately eliminated at each successive statement or comment until a manageable number remains.

4.7.3 **There is no such thing as perspective-neutral data.** A fact (or a representation in the Theory aspect which purports to be of a fact) carries its perspective space with it, implicitly.

4.7.3.1 It follows that to make a message perfectly explicit, the entire relevant perspective space must be specified.

The intention behind a message is to indicate a certain view and then to say (or ask or suggest or demand or whatever) something about it. (The psychology of the matter is not our concern, only the perspective considerations.)

4.7.3.1.1 In ordinary discourse it is usually unnecessary to be expli-

cit about the space since it is understood from the context, but where an ambiguity is detected the discussion always turns to distinctions of some kind. (This is why it takes so long to find out what someone else means by "God".)

4.7.3.1.2 Even defining terms is a way of pointing to a space - except where it is just substituting an expression for another expression, for the sake of brevity or verbosity.

4.7.3.1.3 To specify a field space in a certain context it might be necessary only to point out examples of elements (e.g. mugs and telephones, or colours and textures etc.). It might, alternatively, be necessary to set up schools to train people to see a field. It depends on the range of perspectives already available to the people concerned.

4.8 Two perspective spaces can be incompatible and yet still **mutually sensitive**, in the sense that a change in the world might be seen in both spaces. This means that in planning something it might be necessary to take several different spaces into account.

4.8.1 Translating a change from one space into an incompatible one is a futile endeavour without the benefit of looking and seeing, or some analogue of that, because of the incompatibility.

4.8.1.1 A representation which makes sense in both spaces will serve as such an analogue. The same Mona Lisa is available to the pixel counter and to the viewer who enjoys the enigmatic smile.

4.8.1.2 Conversely, if a representation in one space does make sense when seen in another, then the two spaces will be mutually sensitive.

4.8.1.2.1 Since there is, we may assume, only one world, all perspectives on the world which make sense are mutually sensitive.

4.8.2 **Mutual relevance** is mutual sensitivity where it matters. This is something to be discovered in the individual case, according to the particular purpose in hand and values in other perspectives.

4.9 **Values**, such as aesthetics, morals and interests, are inherent in their perspective spaces. They are functions of the distinctions and dimensions which make up the space, and by virtue of them the state of affairs in the space is more or less desirable. An identical space, but with different values on it, is not the same space and might actually be incompatible.

4.9.1 For example, rich and poor might agree completely on the facts about how wealth is distributed, but clearly they see and appreciate those facts quite differently.

4.9.1.1 This ties in with commonsense thinking about facts and values. A dispute about facts can be resolved by matching the spaces and looking at the view; a dispute about values is a dispute about the appropriateness of the space.

4.9.2 Values give rise to **purposes** when there is an intention to make changes in the state of affairs so as better to conform to the ideal. Purposes therefore reflect values, but are independent of them in the sense that a purpose might conflict with a value in another (incompatible but sensitive) space, whereas if values conflict the space is incoherent.

4.9.2.1 That is, a purpose can be represented in spaces other than that in which its corresponding value gave rise to it. It may happen that the goal thus translated turns out to be quite unacceptable in the new space. This translation is therefore often a necessary part of policy decisions.

4.9.2.2 The values inherent in the perspective being communicated may not coincide with those reflected by the speaker's purpose in communi-

cating it. Nevertheless, the speaker's purpose still reflects values in some perspective, the one he is currently adopting (perhaps secretly).

4.9.3 **Appropriateness** is a matter of perspective choice. Given a problem, some perspectives in which it can be formulated (and which are relevantly sensitive to it) are less appropriate than others, either because their toolkits are less effective, or because they add (or, alternatively, ignore) other quite different problems than the one in hand.

4.9.3.1 Checking a space for appropriateness therefore involves looking at other spaces and comparing them according to values in the meta-perspective.

4.9.3.1.1 Since there is no limit, in principle, to the number of meta-levels of perspectives, the values which determine appropriateness are bound to be ultimately arbitrary.

CHAPTER FIVE : SOME ACTUAL AND POTENTIAL RESULTS

Contents: Page

5.0 Introduction

Having brought together a variety of concepts relating to perspective relativity, in this final chapter we can indicate some possible areas of application of these ideas.

In the first instance, PR is a plea for tolerance of other views' existence as a prerequisite for better communication between people, especially where there is a real or apparent conflict of interests. If it were no more than this, though, it would almost certainly fall on deaf ears because bigotry sets its own limits on the field beyond which the bigot has, often deliberately, prevented himself from seeing. No amount of argument can help, because anything outside the limit is, literally, meaningless. The psychologists might have more to say here, for example that the root of a closed mind is fear, but the mechanism of bigotry itself is a fact about perspectives.

We have found that PR has yielded not only negative results such as this, but has several positive results as well. Perspective differences are not always obstacles to communication and even where they are, PR can indicate ways to deal with them. In some cases an explicit consideration of the perspective idea will be necessary, but since (to be realistic) in a genuine argument it will be very rare for both sides to sit down and discuss perspective spaces, it will be generally only used by one side. In other cases, e.g. libraries or expert systems, some form of perspective relativity could be built in to the system to enable users to make themselves better understood.

Aside from the practical problem of making oneself understood for a particular purpose, PR can be of use in philosophical problems which lie in the background of our personal and technical lives. It allows for flexibility of definitions, such that different distinctions can be used for different purposes. Sowa's example, cited above, of the distinction between a person's body and its surroundings is a case in point. Ethical considerations of life and death are affected by this.

Finally the problems of duality, with which this project began, can be

clarified by considering them as incompatible but mutually relevant perspectives on the world.

Let us take some problems in each of these areas and consider them in terms of perspective concepts.

5.1 Politics

The concept of politics is wide-ranging and covers anything from running a nation to establishing or maintaining a pecking order in a small group. This in itself opens up different perspectives on politics itself; that national politics is 'no different' from the politics of the classroom except that the toys they are fighting over are bigger and more dangerous is a perspective some people sometimes adopt. As a statement, it is true in some perspectives and false in others, and therefore potentially controversial; as an indication of a perspective, however, it is neither true nor false but can only be valuable, dangerous, tasteless or something of that sort.

All kinds of personal and professional relationships are affected by perspective considerations; a doctor may have difficulty persuading a patient that he knows what he is doing, or a designer of anything has to be sure he knows what the user requires, and so on.

5.1.1 Political models

Different perspectives on political structures can give rise to different models of how they work. Allison (1971) gives three analyses of the Cuban missile crisis of October 1962, when it seemed that the United States and the Soviet Union were at the verge of a nuclear confrontation. The Soviet Union placed strategic missiles on Cuba, the United States responded by a naval blockade, and the Soviet missiles were subsequently withdrawn. Analysts are still puzzled as to why these decisions were taken.

In Allison's first model, the government is seen as a rational actor

who makes strategic calculations according to a well-defined situation; in the second model it is seen as an organisation with standard procedures and routines responding to particular features of the situation; finally in the third model it is seen as a power game among individuals. Here is an extract from his concluding summary:

> "To explain the blockade, the Model I analyst examines the U.S. strategic calculus: the problem posed by the Soviet missiles, relevant American values, and U.S. capabilities. Explanation *means* placing the blockade in a pattern of purposive response to the strategic problem. For a Model II man, this "solution" emerges as the by-product of basic organizational processes. The analyst emphasizes organizational constraint in choice and organizational routines in implementation. Organizational processes produced an awareness of the problem on October 14 (rather than two weeks earlier or later); organizational routines defined the alternatives; organizational procedures implemented the blockade. These features overshadow the "decisions" of the unified group of leaders within these constraints. ... The Model III analyst accents the action of players in the relevant games that produced pieces of the collage that is the blockade. Bargaining among players who shared power but saw separate problems yielded discovery of the missiles on a certain date in a special context, a definition of the problem which demanded strong action, a coalition of Presidential intimates set on averting holocaust, failure to probe the military estimate, and consequently a blockade. In the absence of a number of particular characteristics of players and games, the action would not have been the same." (Allison, 1971, p250-1)

Further on, he comments:

> "... while at one level three models produce different explanations of the same happening, at a second level the models produce different explanations of quite different occurrences. And in-

deed, this is my argument." (Ibid., p251)

Each model highlights quite different features as relevant to the question, why did this happen? It is not a matter of the three models competing for the correct answer; there will only be competition if two answers together give rise to a contradiction. In this case, we can imagine models II and III being put together by considering power games within organisational constraints, so each explanation enriches the other. Model I in this example is the odd one out; it requires much less detailed information as to what happened, and only needs an explanation that will fit the outcome. The space is incompatible with the other models, since the mechanisms and machinations of the people and organisations involved do nothing to add to or subtract from the view of the nation as a single rational decision maker. Even so, the second and third models can be sensitive to the first, in that it provides a simplified overall view which may affect the operation of the details.

5.1.2 Negotiation

The effect of values and goals on a perspective space is well illustrated in Fisher and Ury, (1981). While in the format of a 'how-to' book, **Getting to Yes** is a result of serious work carried out by the Harvard Negotiation Project to explore the principles of successful negotiation at any level. Two of the many sensible points they make are the following:

1) that it is essential to show the other side that you fully understand the problem from their point of view,

and

2) that the negotiator should aim to turn the situation into a partnership where both sides attack the problem, not each other.

On the first point, it is obviously likely that if you ignore the other side's case they will be encouraged to ignore yours, leaving the situation to slide into a battle of wills. The more interesting

aspect of listening properly to the other side, though, is that their interests in their perspective might be quite different from their interests as seen in yours. The authors stress that this does not mean that you have to adopt their perspective; on the contrary, you can use your understanding in several different ways, e.g. pointing out other consequences, or simply fostering a sense that mutual co-operation against a mutual problem is feasible.

On the second point, the aim is to find a perspective space in which both parties feel comfortable. This may involve bringing in a third party to arbitrate, or deciding on an objective standard which is independent of the will of either side but which both can regard as fair. On the other hand, it may call for creative invention of new "options for mutual gain". This involves, among other things, the identification of shared interests - states of affairs which are desirable for both sides - and finding items in the bone of contention which are valued much more highly by one side than the other, so that the gain to one is a small loss to the other.

In perspective terms, negotiation generally begins as a case of a Category B perspective difference, where the spaces overlap and certain facts are agreed upon, so the POV can be regarded as shared to that extent. Then the usual model, as Fisher and Ury point out, is a tug-of-war along one dimension - for example, a landlord and tenant want to pull the level of the rent opposite ways, according to their respective financial interest. In our terms, it is along this dimension only that the POV is not shared, and each party attempts, by fair means or foul, to persuade the other to come over to his position. This is again in line with common usage, where a dispute is referred to as a difference in point of view, or a difference in negotiating position.

It is this model of negotiation which Fisher and Ury repudiate, because it is a battle of wills with no attempt at co-operation. The goal in negotiation, for them, is to reach a solution which is genuinely acceptable to both sides. The subtitle to the book is "Negotia-

ting agreement without giving in". This involves looking for options which do meet with the other side's interests as well as one's own - that is, the other side's problem is not just his problem. The focus of discussion shifts from positions along a dimension to a wider range of interests. We could say they are talking about values, but more importantly the tactic is to explain one's own extension to the space, outside the intersection, and ask the other party to explain his. This can open up the possibility of a much wider range of possible solutions than points along a single dimension.

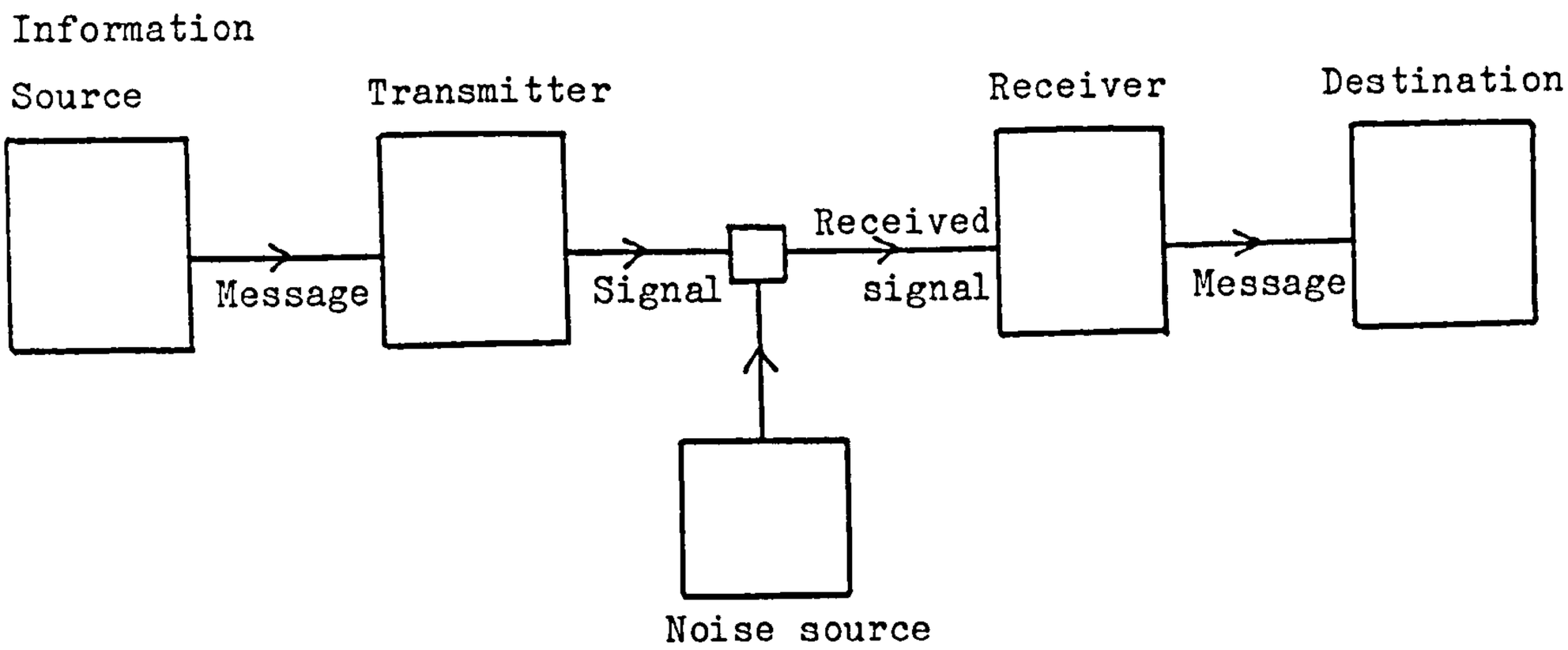
Co-operation, as we have seen, involves a difference in POV but a shared space. The larger the space, the better; bringing in a wider space on both sides is likely to make it easier to reach a suitable degree of co-operation than cutting out as many dimensions as possible on the grounds that they are *prima facie* irrelevant.

5.2 Signals and messages

Let us now turn to the problem with which this project began, that of the 'relation between' signal and message, with a view to finding a way of manipulating meanings in a way analogous to symbol manipulation. Obviously the problem is vague, otherwise we would know at once where to look for the answer. We know a fair amount about why it is vague, because of the large number of attempts to answer it. Shannon, for example, has given us a clear elucidation of the perspective space where we find signals transmitted along channels, and a number of useful engineering discoveries have resulted from it.

Shannon's theory includes notions such as coding, redundancy and the statistical notion of entropy, and one is tempted to imagine that these concepts apply also to messages, by analogy.

Shannon's diagram of a communication system (from Shannon and Weaver, 1949) is reproduced overleaf:



Weaver, in his Introduction to the book, envisages adding the semantic element of communication directly to this diagram:

> "One can imagine, as an addition to the diagram, another box labeled "Semantic Receiver" interposed between the engineering receiver (which changes signals to messages) and the destination. This semantic receiver subjects the message to a second decoding, the demand on this one being that it must match the statistical *semantic* characteristics of the message to the statistical semantic capacities of the totality of receivers, or of that subset of receivers which constitute the audience one wishes to affect" (Shannon and Weaver, 1949, p26)

If an example of a signal is a string of dots and dashes, say, then an example of a message is a string of letters and numbers. The statistical characteristics of the signal depend on the relative probabilities of different possible signals and yield a quantity which Shannon eventually called "entropy". Shannon is quoted as saying:

> "My greatest concern was what to call it. I thought of calling it 'information', but the word was overly used, so I decided to call it 'uncertainty'. When I discussed it with John von Neumann, he had a better idea. Von Neumann told me, 'You should call it entropy, for two reasons. In the first place your

> uncertainty function has been used in statistical mechanics under that name, so it already has a name. In the second place, and more important, no one knows what entropy really is, so in a debate you will always have the advantage.'" (Tribus and McIrvine, 1971)

The notion of entropy, especially when given a minus sign (negative entropy) and put forward as a general measure of orderliness, captures the imagination. Schrodinger explains entropy for the layman thus:

> "At the absolute zero point of temperature...the entropy of any substance is zero. When you bring the substance into any other state by slow, reversible little steps...the entropy increases by an amount which is computed by dividing every little portion of heat you had to supply in that procedure by the absolute temperature at which it was supplied - and by summing up all these small contributions. ...the unit in which entropy is measured is cal/°C...
>
> "... Much more important for us here is the bearing on the statistical concept of order and disorder, a connection that was revealed by the investigations of Boltzmann and Gibbs in statistical physics. This too is an exact quantitative connection, and is express (sic) by
>
> entropy = k log D,
>
> where k is the so-called Boltzmann constant ([dimension] cal/°C), and D a quantitative measure of the atomistic disorder of the body in question." (Schrodinger, 1944/1967)

Schrodinger goes on to suggest that organisms maintain their high level of thermodynamic orderliness (measured by the reciprocal of the quantity D, which gives the expression for entropy its negative sign) by turning highly ordered substances into relatively degraded ones.

This is a valuable perspective on life, but it needs chemistry and

biology to explain why some highly complex substances are poisonous. The analogy when pushed this far loses its grip and becomes an unsolvable puzzle instead.

Mackay discusses the mathematical notion of entropy in terms of his concept of "selective information" (measured in bits), but he comments that:

> "The entropy or selective information-content of a selection should not be facilely identified with the physical entropy of thermodynamics. The two are equivalent only in the particular case where the ensemble from which the selection is made is a physical one defined for a state of thermodynamic equilibrium." (Mackay, 1969, p174)

The statistical characteristics - and hence the entropy - of a message are found by looking at the relative frequencies of different letters or words in natural language. On the level of meanings, such factors as what the source is more or less likely to want to say would have to be taken into account; this is easy enough to illustrate where there is a definite number of possible messages (for example, 'yes' and 'no'), but to talk about the 'semantic capacities' of audiences is no more than an extension, perhaps fanciful, of the analogy between signals and symbols.

The nearest we get to a message in Shannon's perspective is a string of symbols which is one of a definite number of possibilities. The higher the number of possible messages, or the more equal their respective probabilities, the higher the entropy (uncertainty) of the source and the higher the amount of information gained when the message is received. This is a long way from the (albeit muddled) perspective of the original question, where the idea of a message had something to do with meaning. Weaver says that these statistical considerations are essential to an understanding of effective communication, even though they have nothing to do with meaning. Then at the

end of his article, he says:

> "One has the vague feeling that information and meaning may prove to be something like a pair of canonically conjugate variables in quantum theory, they being subject to some joint restriction that condemns a person to the sacrifice of the one as he insists on having much of the other.
>
> "Or perhaps meaning may be shown to be analogous to one of the quantities on which the entropy of a thermodynamic ensemble depends. The appearance of entropy in the theory ... is surely most interesting and significant."
> (Shannon and Weaver, 1949, p28)

The analogy has led to a 'twenty questions', or multiple-choice, paradigm for meaning which completely disregards perspective relativity. Indeed, PR might be used to put forward a speculative theory whereby we can calculate the entropy of a source by enumerating all the spaces that source uses and all the things that source might want to say in a particular context in each of the spaces, listening to the source for a while and counting the relative frequencies. We probably do this subliminally with people we know well, as a result of which they become more 'predictable'. As a model for meanings with a view to incorporating them into a general theory of communication, however, it is inadequate for several reasons. First of all, even though it brings PR into the theoretical formulation, the perspective on meanings it suggests is too narrow. Secondly, people's entropies as viewed in this way change from moment to moment, and not only because of changes in context. Thirdly, Shannon's other concepts, such as coding and redundancy, are inappropriate when applied to a theory of meanings. While we do speak of 'deciphering' what a person is saying, and could well call empty talk 'redundant', it would be a mistake to be seduced into thinking that these figures of speech are very fertile. They provide one limited perspective on one aspect of meanings, and may give the impression that, after all, the perspective space of the signal and that of the message are compatible.

So the next step is to try to clarify our perspective on messages. Using our user-system analogy for the questioner and the finder of an answer (here the same person), the system only has the user's input to go on, and so must now ask the user for clarification of his perspective on messages, since there are many possibilities. Examples of messages will not help, since they are also examples of signals. To narrow down the range, the system could use information as to what, in the user's perspective, messages are not, so the question formula suggested is:

Messages as distinct from what?

Whatever answers the user gives can then be put on one side, as irrelevant perspectives on messages; for example: symbol strings, word strings (e.g. a telephone message as taken down by an intermediary), and any representation of a state of affairs in any perspective space. A message is all of these, in other contexts, but not in this one. A message is also the effect it has on the recipient, but in such cases often the message received is not the one sent, as when the sender (or the recipient) is being subtle. Again, this is not quite the perspective we are looking for.

The closest we have come so far is the perspective which sees a message as a representation of some state of affairs in the world. Why did the user reject this? The answer in this case is that the notion of representation is as ambiguous as that of message; however, this perspective is the only one which includes what is being represented and is objective without being behaviourist.

The effect on the recipient, on the other hand, was rejected because a message, as the user conceives it, is something which the sender and recipient can both look at in the same way; whatever else goes on between them is incidental.

(It must be pointed out again that we are not looking for a definition, and thereby rejecting perspectives because of counterexamples. Perspectives are rejected because they don't feel right. Only the

user can judge this; the system can only pick up the pieces.)

One last resort for the system, when all its perspectives on messages are exhausted, is to look through all the distinctions in its repertoire until it arrives at a set which is manageably small. (E.g. is a message observable or not?). Fortunately in this case the system does have something to work on: the message as something potentially public to anyone who can view its perspective, and the message as something being represented - as distinct from the representation itself. In the case of a line drawing, for instance, the message is the world shown in the picture, not the picture itself; the perspective space of the message is that of the objects or relationships depicted. We are, in fact, in a perspective close to Langefors', quoted in Chapter 1, on messages. The reason for arriving at it in such a roundabout fashion is only to illustrate the kind of negotiation that is often required.

Let us look at some perspectives on signals and messages, now that we have an idea of what we mean by 'message'. The sender's perspective and the recipient's perspective are the important ones for meaning; the others (those of the telephone engineer, the psychologist, the linguist and so on) only come in when something goes wrong with the toolkit. The channel, the language, the reading and writing skills and so on are all, from the communicators' points of view, taken for granted as part of their respective toolkits.

a) In one perspective on communication there are two people communicating away, without a thought for the means. The conversation need not be grammatical - it need not be in language even; very often the less is being said, the more is being communicated (as Weaver suggested) although this is by no means always the case since some communication calls for a lot of talking - e.g. telling a friend about a recent trip.

To say that the perspective space of the message is background is slightly misleading; the perspective space must be an integral part of the message, however little syntax is devoted to it. The notion that

what is already known need not be said applies equally to the indication of the space (setting the scene) and to the information about what is going on there.

b) In another perspective there might be a difficulty in communication which results from a perspective difference between the two people. If communication breakdown at the level of (or in the perspective of) perspective difference can be understood better, then perhaps syntax and semantics will be more forgiving. We saw the different categories of perspective difference in section 4.4., and the kinds of effect they have.

Category A, where the POVs are different but the space is the same for both people, is the ideal case for communication. (If the POV and the space are both the same, then the conversation is probably polite and formal with no exchange of information.) It is Categories B and C which call for conversion.

First we must ascertain that the problem is really in this space and not that of difficulty of expression. This is harder than it seems, because it is easy to assume that the other person is fully satisfied with the way he is expressing himself. If he is satisfied, and you still do not understand what he means or find yourself disagreeing with him (discussions about God are a notorious example), then there is probably a perspective difference. If the POV is the same it is Category B, with the spirit of persuasion. Otherwise it is Category C, which may or may not be convertible.

c) In a third perspective, the perspectives are the same but difficulty might arise in the expression, i.e. in the Theory aspect. This is the problem we encounter when we know what we want to say, but don't know how to express it. This is a matter of convention, and the most effective cure is practice, which may or may not need to begin with mastery of the syntax, as in learning to read. At present, machines tend to begin by learning to read, whereas children begin by interacting with the world. Syntax is therefore of primary interest

for designing the former, whereas spelling and punctuation errors - and even misuse of words - are in humans often considered merely a nuisance.

d) A fourth perspective involves the practical problems of getting the expression across the intervening medium, e.g. Morse code, semaphore, speaking loud enough and so on: Shannon's perspective.

Any number of these types of difficulty might occur at any one time, but each must be solved according to its own perspective's toolkit. They are interdependent only in the sense that they are all necessary for effective communication, each in its own perspective space. In other words, the spaces are mutually relevant, in the sense mentioned in Chapter 4 - that they are mutually sensitive in a way that matters, and therefore constrain one another. Each perspective does not just presuppose that all the perspectives 'below' it are functioning properly; it presupposes those 'above' it as well. This is in contrast to Nauta's suggestion that transmissional, syntactic, semantic and pragmatic semiotics are related by one-way embedding.

Therefore the engineering problem of giving a machine the capacity to mean what it says will involve taking into account the mutual sensitivity of these different perspectives, but will not require the integration of all the aspects into a single space. Instead, what is needed is a way of incorporating perspectives, and meta-perspectives, into the system by any means which happen to work. If pattern recognition 'ultimately' involves pixel-matching, this does not entail that it is 'nothing but' that, but only that the system functions as a pattern recogniser in the user's perspective space. If a system does include a PR function, it may still have to do it by matching representations, but that says nothing fundamental about PR, only about current technology.

Philosophical reductionism, of any sort, becomes highly misleading. The argument between those who wish to reduce everything to one funda-

mental ontology, such as physics, and those who maintain that 'the whole is greater than the sum of its parts' (a seductive notion for beginners in cybernetics), is a needless (and fruitless) controversy. If the perspectives were examined, we might find something like the following:

Reductionist: the subject-matter of physics is all there is. If you look at the world through the 'lens' of physics, within the limits to observation which are well enough understood, you will see what the world is made of and how it works. There are no other components, such as information, or Mind. Therefore, in principle, everything can be ultimately explained in terms of physics.

Opponent: the reductionist is obviously wrong - you can put the physical components of the world together any way you like, but there is no possibility of explaining our mental lives in those terms. It would be bad enough trying to follow biological processes in terms of physics, and many essential factors would be lost in the attempt. Therefore, the sum of the parts is not all there is to the whole, even if there is no 'mental substance', or 'information substance'.

We can see that their perspective spaces are different. One looks at the physical world, sees no life or information or Mind, and concludes that these things are not fundamental. The other looks at life, or systems, or whatever, and concludes that the physical world is not all there is. 'Emergent' properties are postulated, to try to maintain the insights of both views.

If we abandon the attempt to combine the two perspectives, and merely note their mutual sensitivity, we can satisfy both sides of this particular portion of the controversy. The reductionist can maintain his view that physical entities are all there is without having to show that other views can be explained in those terms, since the other views do not contradict him. His opponent can afford to abandon his disquiet by seeing that the parts and the whole, where they seem to differ in character, are seen in different and incompatible spaces.

To say that the one is greater than the other carries inappropriate implications, in particular that a heap of parts and a functioning whole can be coherently compared at all.

To explore mutual sensitivity, one method might be to make a change in the relevant fragment of the world as seen in one perspective, and then switch to the other perspective to see what, if anything, happened there. In this way we can at last look for relations between incompatible spaces with less danger of incoherence. It is probably a mistake to speak of one change 'causing' the other, though, because that carries the suggestion of a nonexistent bridge. Causal links, if any, are quite independent in the two spaces in so far as they are incompatible. This may seem paradoxical, but it is less confusing than the alternative. (If applied to the mind-body problem, for instance, the result is that it makes no sense to ask whether mental events cause physical events and vice versa.)

Quantifiable links between incompatible perspectives, such as that of signals and that of meanings, are often of a statistical nature. Indeed, the various notions of the entropy of a source of information, according to whether the perspective looks at the stream of alphanumeric characters or the repertoire of things the source might want to say about the world, provide a good example of this. It may be that all statistical results could be seen as indications of mutual sensitivity between incompatible perspectives.

We have seen two broad ways in which perspective relativity applies to the problem of meanings. In the first place, meanings only make sense in a perspective incompatible with the transmissions of their representations and so will not be found there, however closely we try to examine those transmissions. Secondly, meanings themselves are subject to perspective relativity, in that if a message is to convey a meaning the perspective in question has to be included, perhaps implicitly, before the meaning can be understood.

5.3 Different user views

How do we make even one perspective available to a system which as yet does not have it? This is a large problem, which is beyond the scope of this project to solve; we can only make a few suggestions as to the direction the work might take.

Given a problem, we need somehow to build up a perspective space from the way concepts are used in the problem statement. This is in place of 'defining one's terms' and of course does a better job. Defining concepts in terms of other concepts is a good way to arrive at a semantic network, but we have seen that the truth value of sentences (and hence of conceptual graphs) is perspective-relative. Where there are potentially incompatible perspective spaces involved, the system must be able to keep them apart.

5.3.1 Brief overview of AI knowledge representation techniques

A useful summary of research in Artificial Intelligence is to be found in Barr & Feigenbaum (1981), of which Chapter 3 in volume 1 covers knowledge representation techniques. This section is a summary of that summary, followed by some comments as to where perspective relativity might be implemented.

Four kinds of knowledge that need to be represented in AI systems are listed: knowledge of Objects, classes of objects and descriptions of (facts about) objects; knowledge of Events, including sequences of events and cause-effect relations; knowledge of Performance - how to put together sentences etc.; and Meta-knowledge, e.g. knowledge of how well or reliably something is known.

Use of this knowledge involves three stages: a) acquiring more knowledge, b) retrieving facts relevant to the problem at hand, and c) reasoning about these facts in search of a solution.

Acquisition and retrieval are related in that knowledge acquired must be fitted into the knowledge base in such a way that it can be

retrieved when needed. Classification of new data structures, provision for interaction between different structures (sometimes causing interference with the existing ones) and representing them in a way which is natural to humans are all being considered. "Linking and lumping" are two kinds of techniques - if one data structure entails another they may be explicitly linked, and if several data structures are likely to be used together they are lumped together into a larger structure.

Reasoning, from existing knowledge to the answer to the problem, takes various forms in people - by analogy, by generalisation and abstraction, and meta-level reasoning, e.g. 'if I knew it, I'd know that I know it because it's not something I'd forget, so I don't know it'. Formal and procedural reasoning - syntactic manipulation using rules of inference and simulation by running procedural models - are the more successful modes of machine reasoning. There is, as yet, no psychological theory of knowledge representation, and the research tends to aim for efficiency rather than accurate reflection of how humans do it.

The scope and grain size of a representation depends on the intended application, and some things are more easily or naturally represented than others. Part of the art of AI research is getting a feeling for what it means to be "represented more easily".

The problem of indeterminacy - that two sentences with quite different structures can mean the same - tends to be tackled by choosing certain "semantic primitives" and canonical representations, such that two structures that mean the same thing reduce to the same network of primitives. One form of attempt to do this is to incorporate 'frames' (see Minsky, 1974) and 'scripts' into the program. A script is a typical scenario, for example that of ordering a meal in a restaurant. Each element, the waiter, the menu, the prices, the food, the bill etc. has its place in the script. A frame is a conceptual graph with 'slots' into which certain kinds of element may be entered, and others excluded. These techniques serve also to eliminate certain kinds of

meaningless statement, but they do so by explicit preprogramming, and not by feedback from the world.

Modularity is a desirable feature, whereby data structures can be added, deleted or modified without disturbing the rest of the database too much. Otherwise, all the interactions in the system have to be understood in order to modify the system, which with large databases can be impossibly difficult. Unfortunately for current techniques, much human knowledge is inherently nonmodular, and even the meanings of data structures depend on context. Some formalisms are more modular than others, but in many contexts these formalisms are inappropriate.

We can see from this thumbnail sketch, without going into any more detail, that AI research has still not been able to tackle the fundamental problem of manipulating meanings themselves - the best attempts still use ever cleverer tricks of manipulating syntactic structures and using procedures to make the system seem to know what it is doing. Any mistakes it makes are patched up by new ad hoc rules. It is impressive, but as the systems grow they must become more and more clumsy and difficult to keep on an even keel.

Let us focus on the matter of modularity. In perspective terms, any new fact will modify any view in which it makes sense. Because of this, the modules in the system must either be all mutually irrelevant in any context, or related in a clear way so that any update can percolate through the system cleanly. In the first case, each module will grow until the modularity becomes meaningless, since it cannot be split into mutually irrelevant parts. In addition, the classifications must be rigid. The other approach, to relate contexts in a way which reflects the perspective relativity we have noted, does not appear to have been seriously attempted (although some recent work on "idea processing" packages come close). The system will need some kind of analogue of the Experience aspect of each of its conceptual graphs (sentences) and schemas.

5.3.2 WISARD - a bottom-up approach

Searle (1980) gives a scenario, now famous, of a person with no knowledge of Chinese being locked up in a room with a short story, written in Chinese, and a rule book for deriving answers to questions about the story by manipulating the characters. The argument is that the exercise would not make any difference to his understanding of Chinese, and that, by analogy, AI systems which contain organised structures of information and are thereby capable of answering certain types of question appropriately do not ipso facto understand what is being represented.

Aleksander and Burnett comment on Searle's critique:

> "The point is that although language and medicine can be organised into structures of information which lend themselves to programming techniques, these structures by themselves do not result in an understanding of the underlying realities; for the abstractions were first achieved by a process of induction, deriving general principles from particular instances, and only become useful in the real world when one has some experience of the actual phenomena they explain." (Aleksander and Burnett, 1983, p.200)

In general, this type of criticism is levelled at the 'top-down' approach to AI which is where most of the research has been directed. The emphasis is on preprogramming, rather than on enabling the machine to learn from experience. The latter approach, it is argued, requires a completely different computer architecture, in the same way that a brain is different from a conventional von Neumann digital computer.

In human terms, the problem is that of understanding the groundwork, mentioned in Chapter 3, needed to prepare for a certain perspective. In contrast to machines, humans begin with sensations which are presumed to be initially quite undifferentiated. Then comes discrimination, between self and the world, between mother and other people and so on. Much later comes language. As Aleksander and Burnett put

it:

> "Now the fact of the matter is that we do not take a human baby out of the crib and start teaching it to play chess, manipulate building blocks or speak English. We accept that before any of these things are feasible the child is going to have to 'grow up' quite a lot - and the essence of growing up is the gradual and progressive gathering of experience..." (Ibid., p.263)

It is not that a computer cannot be programmed to behave like a learning automaton; indeed, many industrial robots do that already. A machine which has a facility for attaching a label to any new state (e.g. state 1, state 2, etc.) and a logical facility for attaching a particular configuration of state and input to a particular output (e.g. if in state 2 and no input change to state 3), ~~then it~~ can be trained to build up a set of these if-then statements as if from experience. It can also build up a picture of the world as a 'world automaton' in a similar way and thereby construct 'from experience' the 'program' followed by the world. That is, if the world is in a certain state (i.e. presents a certain input) and the robot does a certain thing, then the world will change, or not, to another state.

But however sophisticated such a system might become, there are still certain respects in which it obviously does not learn in the same way as a brain does. This is no more evident than in the learning of physical skills:

> "Children, even performing animals, can learn to balance a stick upright on the end of a finger or a ball on the tip of the nose. This is clearly comparable to the job of adjusting the thrusters of a rocket during its launch phase in order to stop it toppling sideways. Yet the child...masters a 'knack'..., whereas the need to keep a rocket at Cape Kennedy in the vertical position requires the attention of colossal computer banks in Houston constantly calculating and recalculating the complex series of equations that govern the vehicle's stability.

> "The point of this comparison is to suggest that when a child... masters a physical skill, what is learned is a pattern rather than a set of algorithms." (Ibid., p.204)

They go on to suggest that the pattern recognition mechanism in the brain might be more fundamental than the logical mode of thought which we use to manipulate symbols and algorithms. It certainly seems that we share this mechanism with other creatures who lack the intellectual facility. Perhaps, they argue, the preprogrammed approach has been disappointing because

> "...it cannot realise its full potential unless it is underpinned by a more fundamental, though perhaps less formally 'intelligent', system operating as a pattern recogniser." (Ibid., p.205)

Igor Aleksander and his colleagues have been working on such a device for some years, and the result is known as WISARD, for Wilkie, Stonham and Aleksander's Recognition Device. WISARD exceeded expectations by being capable of recognising faces (live images, not photographs), and could even be trained to discriminate between different expressions on the same face.

Many aspects of WISARD's design reflect what is known about the brain, as a network of neurons which either 'fire' or do not, according to the pattern of incoming pulses. Thus far, they act as simple logic gates, and it is the synapses (points on the incoming nerves) which control the 'weight' given to the pulses. Attempts to model this kind of arrangement before the advent of the silicon chip were not successful, but now ordinary Random Access Memory (RAM) provides an ideal tool. The neuron can 'learn' by changing its synaptic weights, and this is done by certain dominant synapses which, in effect, can also tell the neuron that the present pattern is the one to fire on in future. This is simple enough to model using RAMs, and the theory behind WISARD begins with this.

The next step was to give the RAM net a capacity for generalisation.

To show it a particular pattern of pixels, for example, and tell it to fire when it sees this pattern again is a long, laborious process, and to teach it to accept even small amounts of noise would mean going through all possible near-misses in turn. Instead of this, the WISARD researchers found a way of letting the net assemble votes, or probabilities, in favour of this being the image it is looking for. This was done by using more, smaller RAMs, with each RAM being allotted one section of the image.

This turns out to be many orders of magnitude more economical, as well as enabling the machine to recognise patterns which it has not been specifically taught - i.e. to generalise. The teaching process involves showing each RAM the perfect image for its particular section, plus all the images which are out by one pixel. Thus in a section which consists of 4 x 4 pixels, the RAM is taught to recognise 17 images as acceptable. Now, each RAM can cast a vote to say that its own section corresponds to the particular image it has been taught. The net result over the whole image, at reasonable levels of noise which are unlikely to be very evenly distributed, should be a majority vote in favour when the taught image is presented.

The more the image is subdivided, the more it can generalise until, when it is subdivided too finely, it gives a positive response to nearly all images, resulting in 'saturation'. The engineering problem, then, includes tuning the fineness of subdivision to a point where maximum discrimination is combined with maximum generalisation.

The next step was to incorporate a form of feedback, whereby the machine sees not only the image but also the number of 'votes' cast in favour of its being the taught image. This serves to increase its degree of confidence in recognising the image. This is analogous to the way we see something we think we recognise, and take a second look to confirm or reject it. The difference is that we compare the image with a remembered image, whereas the system so far only has a crude measure to provide the feedback.

The next level of sophistication is to try to give the machine memory not just of which image was last seen, but of the actual image itself. This can be done by means of the 'data-in' terminals on the RAMs, those terminals which, in this arrangement, are used to indicate when to learn (i.e. setting the synaptic weight, in the neuron analogy).

> "Instead of simply treating the data-in terminals uniformly, putting a 1 on all of them and relying on the address terminals which 'see' an image to store the 1s in the appropriate places, we can connect the data-in terminals to another matrix on which an image can be displayed... If the output terminals are connected to another matrix which displays an image then, providing the terminals are connected to the matrices in an identical fashion, the image that goes in through the data-in matrix will be reproduced on the output one." (Ibid., p.244)

The state of the system is now a 'taught' image, the one on the data-in matrix, rather than merely a number of firings in response to a particular image. Thus the machine can learn to identify a 'seen' pattern by the image it has been taught to associate with it, and can go into that state (i.e. output that image). It can still generalise as well as before, as long as a constant taught pattern is maintained at the data-in terminals for all the input images that are to count as the same thing. In this way the machine can generalise different expressions on the same face.

Feeding back the output (i.e. the 'taught') image and mixing it with the input 'seen' image will have the same confidence-building effect as the simple fire-count did, but with the added benefit of refining the internal image with each successive scan. Now if the 'teach' terminals are directly connected to the input image, it will automatically learn any new image that is presented to it and construct a corresponding (though cruder, owing to the smaller matrix) internal image, which it can output to show the experimenter which state it is in.

Long-term prospects mentioned in Aleksander and Burnett's book include: provision for long-term memory, provision for appropriate responses rather than simply outputting the internal image; connecting the device to a manipulator with a sense of touch so that it can learn about the world in three dimensions; and equipping it with the means of moving about in the world so that it can focus its attention on particular, "significant" areas. These can all be envisaged in terms of connections between neural nets of the kind the authors describe.

WISARD is but one example of a bottom-up approach to AI. It is not intended to cut out preprogramming altogether, but it is suggested that perhaps the introduction of algorithms and heuristics is more a matter of convenience, in getting the machine to fulfil a specific function, than of modelling the brain. Preprogramming of a net would consist of establishing certain configurations of 'synaptic weights' before the system is shown any images.

5.3.3 Images and PR

The question that comes to mind here is whether these images can provide the machine with its Experience aspect. WISARD is, at bottom, still no less a pixel-matcher than Searle in his cell with the Chinese script is a character-matcher.

Nevertheless, the capacity of WISARD to recognise images is closer to the Experience aspect of a perspective than anything we have seen before in AI. While images are generally representations and, as such, come under the Theory aspect, the current explosive work on image recognition and creation, including the use of the 'mouse' on even relatively cheap home computers already, does indicate that images require quite a different approach from language. Benzon (1985) gives an excellent short article on how the mouse and its associated software can actually help us to think; the point is made that while we can all use language with facility, drawing well is a much rarer skill. Those of us who are quite unable to draw with a pencil can now, with this software, start to record images as easily

as we write words. The demarcation between the two hemispheres of the brain (see Ornstein (1972), especially chapter 3) is of interest here because the right hemisphere is the seat of skills and knacks as well as images.

Images used as representations are generally considered to be illustrations of accompanying text, rather than (as Benzon suggests) the other way round. The image, once seen as intended, takes the viewer more directly to the intended perspective than a description in words does. The accompanying words serve to label the space of the image. If no image is presented, then it is constructed or recalled internally.

A jumble of pixels is not an image in this sense, until there is some way, however primitive, to see distinctions in it (assuming that the pixels themselves are of no interest). Only then does it become an image at all, because only then does it become more than meaningless noise. There is a style of picture which at first sight looks like a meaningless patchwork in black and white. A relatively famous example is "The Hidden Man", reproduced in Abercrombie (1960), p26. The way it is explained usually takes the form of pointing out the eyes, chin, beard and so on, until suddenly the image is seen as that of a man. Once seen as such, it will never look like a meaningless patchwork again. Another style of picture is a technique whereby the picture is divided into squares which are quite large relative to the details in the picture, and the squares are filled with the 'average' colour (or shade of grey) of that portion of the picture. The result only makes sense when seen from a distance, even when you know what is being represented, because, we assume, the resolution at a distance is closer to what we are accustomed to.

This of course does not mean that we need to have seen that picture before, but only that we have experience of the relevant distinctions. Do we therefore have to give the machine all the distinctions it will ever use? Like humans, it will never see what it is not prepared to see - unless it can wander among different perspective spaces.

A useful strategy might be therefore to work on giving the machine meta-perspectives as well as particular distinctions. We could envisage it drawing analogies and thereby creating new distinctions for itself. We could also envisage that, having settled upon a coherent perspective space (by search or matching, perhaps), it would not need to match pixels to internal learned patterns to interpret the image.

5.4 Problems in information retrieval

One area which badly needs a technique for meaning-matching is that of information retrieval, for example in the use of libraries. The traditional problem is this: given an information store and a query, what is the best method of retrieving all and only the material which is actually relevant? Specific references are easily enough found in an alphabetical catalogue, but if the user is not yet familiar with the literature or, alternatively, with the library classification system, he might not know where to start looking. The most common stumbling-blocks appear when the user has difficulty in specifying what he wants (for example at the outset of a research project), and when the query, once specified, does not fit easily into the prevailing system of classification. Problems also occur with the classification system itself, when new material begins to accumulate in one area (e.g. technology) creating an imbalance and putting a strain on the old classifications.

Thus there are two closely related problem areas: that of representing the documents (e.g. by abstracts, indexing etc) and that of representing the query. Two traditional concepts should be mentioned, namely recall and precision. Recall is the proportion of relevant documents that are retrieved (i.e. a measure of whether the net was thrown wide enough to catch all relevant documents), and precision is the proportion of retrieved documents that are relevant (i.e. a measure of whether it was narrow enough to exclude irrelevant material). There has been some discussion about what appears to be an inverse relationship between these two quantities, i.e. the hypothesis that to

increase recall is to decrease precision and vice versa. This seems to put a limit to the performance of IR systems, since a reasonable goal would presumably be 100% recall and 100% precision. A very technical examination of the 'inverse law' is given in Robertson (1975). In particular, the point is made that where the 'law' might work for one independent variable, it might not apply where more than one variable is taken into account.

A number of quite recent papers in the fields of information science and information retrieval research are concerned with examining the basic assumptions and proposing alternatives with their accompanying new strategies. Belkin and Robertson (1976) attempt to derive a "spectrum of information concepts" from the basic premises a) that information science is problem-oriented, and b) that the one notion common to all existing concepts of information is that of change of structure, whether it be structure of text, of recipient, or even of sender. Boulding's (1956) concept of the "image" - the particular mental conception each of us has of the world and our place in it at any time - is taken as a starting-point. The point is made towards the end of the paper that 'we can imagine document retrieval systems which make direct use of the idea of the recipient's image'.

Griffiths and Elsharkawi (1977) put forward the idea that an IR system should be interactive, rather than static, reflecting the philosophical insight that communication is not just a matter of the sending and receiving of data among otherwise isolated individuals, but is a process in which the 'recipient' is also actively participating. They criticise Belkin and Robertson's breakdown for not taking this dynamic, interactive aspect into account.

Meanwhile Pratt (1977), in a discussion of the various uses of the term 'information', points to three distinct areas of meaning of the word: first, there is Shannon and Weaver's clearly-defined notion, which everyone accepts but recognises its limits; then there are two approaches to that aspect of 'information' which is left over. The first sees information as a property of a message, dependent only on

the pattern of symbols, and hence as something akin to a form of energy, whereas the other sees information as a process, that process whereby the recipient of the message is informed, i.e. changed inwardly. Pratt suggests adoption of the term 'emmorphosis' for the latter sense, to avoid needless controversy as to the 'real' meaning of information.

5.4.1 Belkin's 'ASK'

Belkin (1977) looks at this 'emmorphosis' aspect of IR. He points to two traditional assumptions: first, that a more or less formal 'documentary language' is an appropriate mechanism for representing the meanings of both the documents and the query (or request) in abstract terms, and secondly that the so-called 'best match hypothesis' is an appropriate basis for an algorithm which orders the documents according to their relevance to the request. The two assumptions are related in that the best match hypothesis assumes that the information need is precisely specifiable in the same terms as the documents it is trying to match.

Systems based on these and similar ideas seem to be reaching a performance ceiling, and despite various attempts (which Belkin cites) to explain and circumvent this persistent low performance, including suggestions to change the goal itself or to modify it to allow for a browsing facility and attempts to provide 'relevance weighting', there has not been marked improvement.

Therefore what Belkin proposes is to treat IR

> "in the context of a communication system specific to information science" (Belkin, 1977 p.7).

The system is represented on two levels: the linguistic level and the cognitive level. The linguistic level consists of text, generators of text, and recipients; the cognitive level consists of states of knowledge, information (in the sense of informing) and anomalous states of knowledge, or ASKs. The problem facing information science is to

facilitate effective communication between the (human) generator of a document and the user.

Belkin shifts the emphasis from the formulated request to the information need behind it, which might be no more that a recognition that the present state of knowledge is anomalous. Therefore, he suggests, it seems reasonable to represent documents in terms appropriate for representing anomalous states of knowledge (ASK), rather than vice versa.

This approach immediately points up new problems, because there are different types of ASK, and because there might be alternative ways of resolving the anomaly. But the approach seems to be on the right track if only because the information-as-property approach has reached its limits.

In a design study for an interactive IR system based on the user's ASK, Belkin, Oddy and Brooks (1982) begin with the view that, since the user is unable to specify what will resolve the anomaly in his state of knowledge, it makes more sense to try to discover the ASK than to expect the user to ask the appropriate question right away. In Part 1 they outline a system which takes a user's problem statement (say, 2-3 paragraphs long), converts it to a structural representation of the user's ASK by text analysis, and chooses one of several retrieval mechanisms according to the type of problem structure (PS).

> "... In this context, a retrieval mechanism is a strategy for resolving the anomalous aspects of a PS." (Belkin, Oddy and Brooks, 1982)

The abstract (i.e. the text) is printed out for the user to read, along with a brief explanation of why that particular text was chosen. The user is then asked to comment on this, whereupon the system either stops if the user is satisfied, or changes retrieval mechanism, or modifies the problem structure. The procedure is repeated until the user is satisfied.

The basis of the structures derived and used in the system is word association networks, and strength of association is based simply on lexical separation in the text. In the design study, outlined in Part II of the article, the system was tried out on a sample of genuine users with queries, and one consistent comment was that if anything some concepts were not strongly enough associated by this method, when applied both to the abstracts of the document collection and to the problem statement. Lexical separation has the obvious advantage that it is a simple variable to work with, but the obvious disadvantage that the links between concepts are of many different kinds (to some of which the idea of 'close association' does not apply anyway), whereas lexical separation is strictly a single dimension.

While the variety of types of link between concepts was not considered in the study, it was clearly recognised that there are different types of ASK, and that each type might require a different retrieval strategy. The division of links into categories of strong, medium and weak association, and the possibility of condensing a network by amalgamating clusters of nodes, is enough to cope with (say) the difference between a well-understood topic which the user wishes to read up and a hazy problem still unresolved in the literature. In short, there is already a range of different search strategies available using only lexical separation on the problem statements and the document abstracts.

The authors conclude that their results do much to justify their approach, but that a great deal more work needs to be done in almost all aspects of the system, in particular in refinement of the analytic procedures and in classification of ASKs, as well as the interactive aspect and the retrieval mechanism itself.

To think of an anomalous state of knowledge as a frame or script with gaps waiting to be filled implies that all knowledge is of the 'multiple-choice' kind, where there is a clear menu of possible answers, of which one and only one is correct. The ASKs which give

the greatest problems are quite different in character, because the space itself needs to be made clear.

We immediately have a first step at a possible classification of ASKs, namely the distinction between those where the space is clearly understood but the state of affairs there is not (e.g. what was the date of the death of Richard III?) and those where the space still needs to be clarified (e.g. what on earth is cybernetics?).

For the former kind of query, standard reference works, possibly though not necessarily classified roughly according to perspective space, would probably suffice.

Where the space itself is unclear, there are several possible difficulties. Perhaps the question looked simple enough (to the user) but turned out to be incoherent, ambiguous, or as yet unanswered in the literature. Alternatively, the user knows the query is about the space (e.g. an unfamiliar subject).

It is therefore suggested that perhaps a useful strategy for IR systems in the future might be to aim at narrowing down to a perspective space rather than immediately to a set of documents. Documents can be added to the store according to this type of strategy, possibly making classification less arbitrary than some people suggest it is at present.

Classifying documents according to perspective space would be a formidable task. It might be possible, however, to ask experts in various fields to classify authors according to what they are interested in, so that users with a vaguely specified ASK could be pointed towards their writings. At that point, the title of the work will be enough to tell the user whether the document is likely to be of use to him.

5.5 Conclusion

We have examined four areas which might benefit from some of the considerations put forward in Chapters 1 to 4, but there are many others which might have deserved more attention.

For example, PR can give some general strategies for non-adversarial communication, such as education and explanation. To put this another way, it provides us with a non-technical and non-psychological way of talking about what good teachers already do instinctively. It seems more generally recognised now than in the past that teaching is less a matter of imparting facts than of motivating the student to enquire for himself. Certainly the long term result of education appears to be knowledge not of answers but of where to look for answers.

In abstract subjects such as mathematics and logic, the subject matter is explicitly the learning of perspective spaces. Once the student has grasped what the teacher has in mind it is often as if it was obvious all along. Plato found this a puzzle, and suggested that this 'recognition' is recall from a previous existence and, indeed, reincarnation has been put forward as an explanation for individual differences in aptitude. But we have seen that, given sufficient groundwork in experience and representation, a new way of looking does seem obvious if it is seen at all.

Gregory (1981) makes the distinction between Potential Intelligence and Kinetic Intelligence. Potential Intelligence is a store of solutions to problems which accumulate, both in the individual and in the community, as new solutions are added to the knowledge; Kinetic Intelligence is the capacity to solve a problem for the first time. In PR terms, the store of familiar perspectives and their associated tool-kits, if any, would be part of the accumulation of Potential Intelligence, and Kinetic Intelligence would be the capacity to see things in an entirely new way.

A great deal of the knowledge that we take for granted is easily confused with consciousness itself. Perhaps the POV in a complex, value-

laden perspective space is where consciousness lies, what Nagel calls "the subjective character of experience" (Nagel, 1974), but getting to a POV - what it is like to be there - is problematic for machines. Why this is so is a difficult problem, not least because our imagination does not run to what it would be like to be a machine with certain types of input. The best we can do is to imagine what it would be like to be *ourselves* restricted to those types of input (see Nagel, 1974, p169). We have difficulty stripping down our perspective spaces to those of simple (or, as in Nagel's example of bats, fundamentally alien) systems.

Nevertheless we have found that perspective relativity, as a conceptual exercise, has proved to be useful in clearing some of the ground for a number of problems. The principal difference between our view and what is generally thought of as 'perspectivism' is that in the latter it is assumed that a person builds up one enormous perspective space as he goes through life in a particular intellectual climate, whereas we have pointed out that what we build up is a multiplicity of ways of looking, not all of which are compatible but which do not thereby have to contradict one another.

In the matter of energy and information propagation in particular, we find at least four incompatible perspectives on an act of communication, each with its own kind of measurement, where the only possible relation between them is that of mutual sensitivity which acts 'down' as well as 'up' what is generally regarded as a hierarchy of levels. This is one of two senses in which perspective relativity is relevant to the problem of meanings; it is also directly relevant to meanings themselves, in the sense that the perspective space is more or less explicitly a component of the message, and it is this component which individuates a meaning when the words (or other form of representation) are ambiguous.

PR can offer a way of looking at some philosophical problems. The strategy, in general, is to specify (or at least indicate) the persp-

ective, then to go and look at the view. In delineating the perspective, we can ensure that all of the envisaged possible answers to the question do actually correspond to states of affairs in that space. At this point we can eliminate nonsensical questions and, even more important, we can say why they are nonsense. If there is still puzzlement in that area we can keep looking for a perspective in which the question does make sense.

If the question survives the first stage - i.e. it still makes sense after the perspective has been sufficiently well delineated - then the next step is to go and see. If it proves to be impossible in practice (e.g. to find out if there is an afterlife), then perhaps we can only choose where to place our faith. If, on the other hand, it is possible to look and see, then the philosophical problem becomes a scientific one, and the perspective space becomes part of a paradigm.

In perspective terminology, then, philosophy is (in one meta-perspective) the attempt to articulate coherent perspectives in which to place the traditional puzzlements; looking for answers has no place in the endeavour. Philosophical problems are all pseudo-problems, as they stand; philosophy becomes instead a valuable catalyst separating areas of disquiet into science on the one hand, and religion on the other. The most common type of problem is that in which the two or three proposed solutions each fall into different spaces, which are mutually incompatible. The mind-body problem is a clear example of this. Here we see that it seldom makes sense to speak of a philosophical 'position'. The strategy would be to separate the different perspectives implied by the proposed solutions and then, in each of the alternative perspectives, to find out whether the problem is a scientific one or one to which there is no answer. If the former, steps can be taken to look and see.

Appropriateness of a perspective in a particular situation depends on the purpose which is brought to it. Purposes, in the sense of desired results, are not built-in to a perspective space in the way that we

have said that values can be. For a purpose to be acceptable, though, it must be consistent (to an extent which is included in the judgment) with values in all the relevant perspective spaces, otherwise there might be unforeseen consequences in the purpose's implementation. (One is reminded of the moral of practically every fairy story concerning the granting of wishes.) The appropriateness judgment therefore ultimately depends on everything that the devil's advocate can bring to it and so, in particular, in the matter of truth we arrive at Feyerabend's point that the greater the multiplicity of perspective spaces - even apparently oddball ones - the closer we are to understanding the world. We may have nowhere to lay our head, but free fall may prove to be more comfortable in any case.

Finally, in ordinary human communication where the greatest multiplicity of perspectives is to be found, a number of different strategies are suggested, all of which are common sense but do not appear to depend on 'human nature' and psychology. There is, first of all, Kuhn's suggestion that to read Aristotle sympathetically you have to look for (and try to experience) a perspective space in which what he says makes good sense. Conversely, a person can be in the right place for an experience and never see it because, for one reason or another, the relevant distinctions are not available to him. Perhaps this is WISARD's problem. Communication is sharing, but perhaps more importantly it is a matter of seeing what is not shared, and filling the anomaly with regard to experience or theory according to which of those is lacking.

This has been only a preliminary conceptual study, and much more work could be done in specific areas which has not been attempted here. In the attempt to say nothing which would not be subject to alteration if an alternative perspective were preferred, it is hoped that this notion of perspective relativity has been shown to be innocuous and at the same time to carry considerable potential.

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