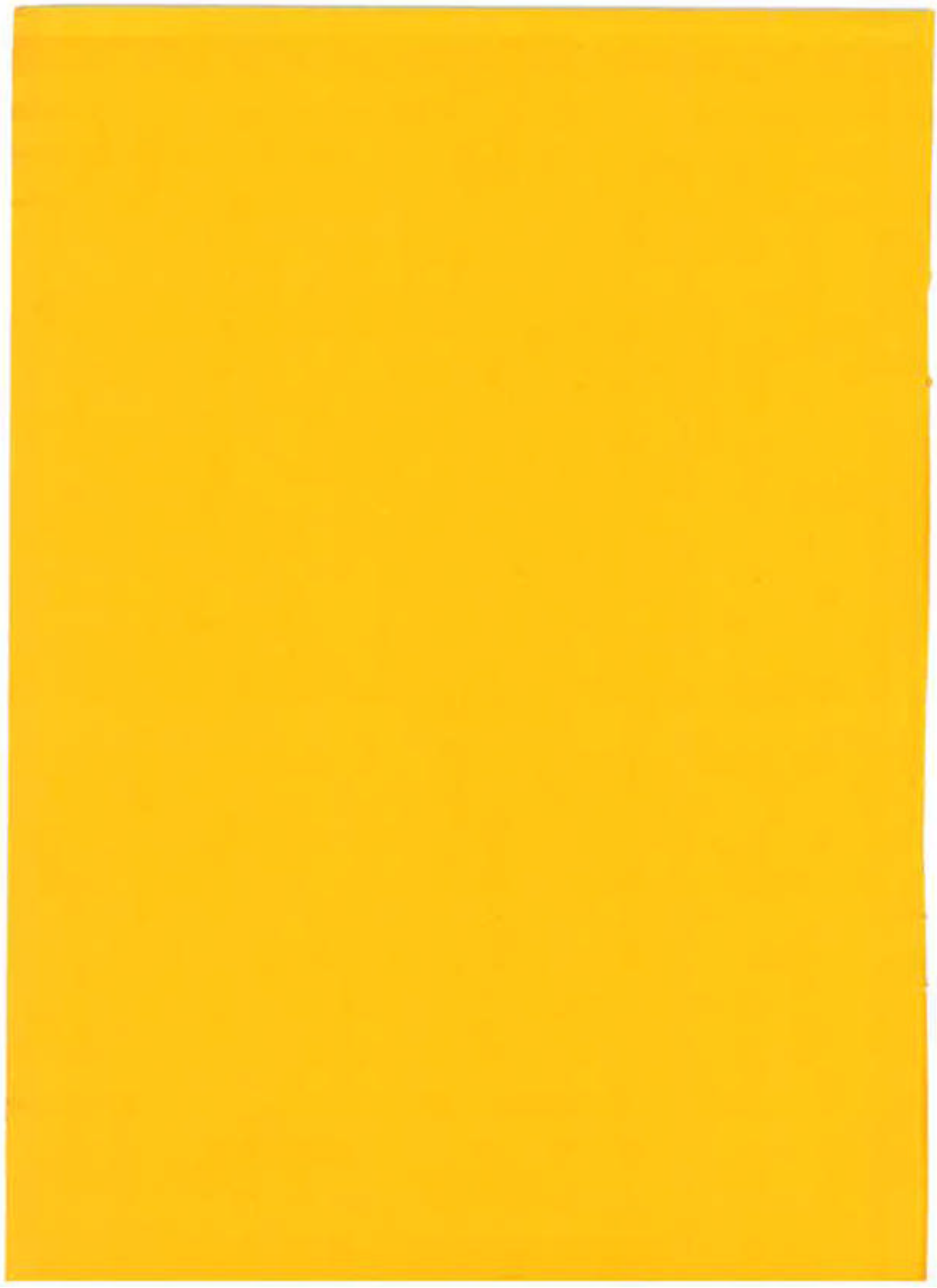
WORKING PAPER 319

MAPS OF READING

A.G. WILSON

WORKING PAPER
School of Geography
University of Leeds



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A.G. Wilson

School of Geography
University of Leeds
LEEDS
LS2 9JT

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1. Introduction

I imagine there is some curiosity about why a member of the teaching staff with plenty of opportunities for lecturing should want to talk to students in a forum outside that of the usual curriculum. I should also say that I had some difficulty in finding a title which might explain my intentions. I suppose that the one I have finally chosen probably doesn't offer much enlightenment. So I'll begin by trying to explain my aims, and at the same time explaining my title.

I start from various rather assertive premises. First, that a university education ought to be about much more than reading a particular subject, for example. Secondly, I thought that perhaps, in a television age, there is a great danger that we don't read enough. And, thirdly, somewhere at the back of my mind, there is an as-yet-inadequately articulated argument that broader reading for students of a particular discipline, outside that discipline, would be useful.

My aim therefore, is to offer a personal, idiosyncratic, guide to some books worth reading across a very broad area. I have to try to define what that area is. I have to justify it enough, and to try to interest you enough, to hope that you will then take it further. In the end, it will only work if you all choose to do some more reading.

This is the sense in which I called the talk: *Maps of reading*. At least the first word had some geographical connotations. It will amuse you, though, to hear something of the difficulties I had in finding a title. Since I want to talk to you about 'everything but geography', I thought of calling the talk just that. Then I decided that that wasn't informative enough, so I considered: 'What should we read?: everything but geography', and that didn't have the right connotations! I then considered 'Reading maps', but I was sure you could come under false pretences thinking I was going to talk about hiking in the Dales. So, 'Maps of reading' it was. There was only one remaining trap: if the title was printed in capitals, or there was, by mistake, a capital R in 'reading', then you might have thought I was going to lecture on the historical geography of Reading. But anyway, now you know what I mean.

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*A talk given to the Leeds University Geography Society, 27th October, 1981.

How can I justify recommending that you read more widely? There are two standard responses to this kind of question: first, to satisfy curiosity about the world; and secondly, because the results are practically useful in some way. I hope that both justifications will count when you consider what I am suggesting. The material presented can justify itself on the first count. The second argument can be elaborated in two interesting ways - by relating 'practical usefulness' to the ideas of 'imagination' and of a 'discipline'. The first idea comes from an animal physiologist with a wider interest in research design, Ian Beveridge[1]. Among the qualities we would all like to have as part of our abilities to think and to create are imagination and good intuition. To some extent at least, it can then be argued, these qualities are fed by our wider reading. If our curiosity (with a sense of pleasure and enjoyment) gets us into a wider range of reading, then this is likely to have unpredictable practical uses by fuelling our imagination and intuition - our abilities to manipulate and call up ideas from unusual quarters - at later times. Beveridge puts this idea as follows:

> "Successful scientists have often been people with wide interests. Their originality may have derived from their diverse knowledge ... reading input not to be confined to the problem under investigation nor even to one's own field of science, nor, indeed, to science alone."

Enjoyment and virtue can be rewarded in ways which are difficult to predict but are nonetheless likely to be there.

The second idea involves us recognising that there is nothing sacred in the way a particular discipline is defined. Indeed, the same 'named' disciplines are often different things in different countries and cultural traditions. Liam Hudson, writing on disciplines in the context of his own role as a psychologist[2], recently argued that the

> "academic landscape (is) divided up at present as arbitrarily as is the map of Europe ... and to be forced to draw back, out of a sense of disciplinary propriety, is surely a very tiresome constraint indeed."

And he argues that, for research, "the real excitement lies at the boundary, not in the heartland" and that

> "those facing one particular part of a boundary (have) much more in common, intellectually, with outsiders who work just on the far side of it than they do with other insiders whose energies are addressed elsewhere."

So on these grounds alone, it is worth looking around widely, although I recognise that here I am casting my net much further than the boundary of one particular discipline. I will return to the argument as to whether this aspect of the exercise is worthwhile in the last section.

Now that I have tried to justify myself at least partially, how can I proceed? In order to be concrete in my suggestions, I offer a reading list which is attached as an Appendix. There are roughly fifty books on the list. This would probably be two years (or more) 'part-time' work for even an assiduous reader. I whittled this list down from a much longer one. And it is obvious that many different people could offer as many different lists, and that each would be structured differently. There is nothing definitive, therefore, about what is on offer here. But it is intended to be reasonably representative of serious reading; and using it as a basis, my hope is that a student who wanted to broaden his or her own horizons could at least take it as an effective starting point. It should then generate a personal list more tailored to that individual's taste.

My maps are at best sketch maps. In the next section, I spell out briefly my demarcation of major territories, and areas within those. Then I take the three major regions in turn.

2. Major territories and some areas within

My major division is between the natural world and the human world. I treat aspects of the first under the general heading of 'science' and the second under the heading 'individuals and societies' by which I mean to embrace social science and aspects of what is customarily called the 'arts'. As a preliminary, though, I consider a third major area. In our reading, we are acquiring 'knowledge' through various processes. It is important to have a critical idea about what constitutes knowledge and the processes of this acquisition. I consider this, first, under the heading of 'philosophical background'.

I will pitch my arguments in terms of arousing, though probably not satisfying, curiosity. The satisfaction will have to be derived from your own reading. Any practical consequences are likely to be of the indirect sort I mentioned at the outset: a deepening of powers of imagination and intuition.

In philosophy, I can really only raise questions: what is the nature of knowledge and truth? Can it offer us any basis for value judgements? What is the nature of language and how does it express and represent meaning? How is knowledge created? And so on.

In relation to science, I think there are some fundamental questions about which it is difficult not to be curious. What are we made of (at the most micro-scale)? What are we part of? What is life and how does it evolve? It is possible to offer some insights into these areas and at the same time to show that science, contrary to much popular belief, is not a cut-and-dried affair. It sizzles with controversy; and, as we know more, the left-over questions become all the more puzzling (and more fundamental). And we may discover, as our imagination is fuelled, fruitful methods and analogies from the most unexpected quarters[3].

We should also be curious about ourselves as individuals: about theories concerned with our motivations and drives; about the processes which create the kinds of societies we live in. So everyone should have some kind of interest in the social sciences and the arts.

3. Philosophical background

The main point about philosophy in this context is that it takes nothing for granted. We can ask questions which at first sight seem to have obvious answers. What exists? What do we perceive? What is truth? What is good? As the sequence progresses, I am already getting into an area where the answers are less than obvious at least some of the time. Philosophers show us that none of the answers are necessarily obvious.

The territory to be covered is vast. The history of the subject stretches for well over two thousand years. All I can do here is to try to articulate the agenda and leave you to sample the reading list.

As an introduction, I recommend Bertrand Russell's *History of western philosophy*. It is well written and relatively easy to understand.

The first major topic to get into is what philosophers call 'the theory of knowledge'. Let me take one example to open this up, which also raises issues which relate to other headings I want to introduce. Consider, critically, an idea we usually accept uncritically: that of a 'fact'. '2 + 2 = 4' is an obvious kind of fact in logic or mathematics, but other kinds of facts have to be related to our experience (or to our beliefs about things we cannot experience). Philosophers show us that this is a complicated business to describe and analyse. A report of an event in my immediate experience may be factual, in my own terms. But how is the record of that experience represented in my mind? Are my 'ideas' the same as someone else's who has observed the same event? If I report my experience in language which is then 'understood' by someone else, is that which is understood the same as that which I communicated?

Philosophers can, and do, take a common sense view of many of these issues, but they show that, even in the simplest of cases, analysis is not straightforward. The potential advantage of having subjected oneself to this kind of thought is that one rapidly becomes more critical of the idea of a fact.

One might suppose it is easiest to get the idea of a fact right in relation to science. Indeed, a good starting point for exploring the theory of knowledge is the philosophy of science. Even here, though, there are difficulties and controversies. This is partly because, as we will see in the next section, some of the theoretical concepts of science are very difficult to interpret even though they relate to 'factual' experiments in at least an indirect way. And it is partly because philosophers of science offer an account of 'the scientific method' which seems to scientists not to be in accord with what they actually do. It is for this reason that I have included a substantial contribution in the reading list on creativity. We should also recognise that the direction taken by scientists is to some extent socially determined - investigations into what is potentially profitable, for example; and also the scientists, like the rest of us, sometimes like to see and believe what they want to believe. The whole process is less 'objective' than it is sometimes said to be.

Questions of value and, say, justice, are more complicated still. Once people looked to philosophers to provide justifications for absolute values - the value-equivalents of facts. Now, philosophers are more likely to say that values which are held, believed in, are socially determined, and that the job of the philosopher is to help explore questions of, for example, consistency. The nearest I can get in my own beliefs to an absolute is a set of values associated with Kant's categorical imperative: what you do yourself, other people should also be allowed to do. If you accept this, you have a justification for most of the things which are legally forbidden. You shouldn't steal, because this implies that others can steal from you; and so on. All I ask now is: try to be explicit about your own value systems; and try some reading which explores some of the issues involved.

The rest of the philosophical part of the reading list is designed to give you a whiff of controversy and of some big questions. The theory of knowledge I have been alluding to indirectly above is broadly what is called positivist. It has become fashionable to criticise this because of its inability to confront questions of value. These questions, it can be argued, can be raised in a philosophical tradition which starts from a different viewpoint: that of Marx. What is indisputable, is that Marx, in terms of a theory of knowledge, offers much insight into the ideological content of meaning in language. (And he offers much else besides which is properly a part of section 5 below.) The big issues are to do with language. How meaning is represented. How we learn it. Whether the Chomskian position can be established that we have an innate knowledge of grammar coded into our brain. And so on. Much too much to get into in a ten minutes' part of something broader; but much that is worth reading.

4. Science

C.P. Snow, in his lecture on the 'two cultures' in 1959[4], argued that a scientific equivalent of asking someone whether they had read a work of Shakespeare was whether they could give an account of the second law of thermodynamics. In a later lecture[5], he said that he had regretted that particular example and would, with hindsight, have chosen one from molecular biology. I will simply argue here that there is a rich choice of examplesof discoveries and problems from modern science which should whet the appetite for further exploration. I include Snow's example from molecular biology, but a number of others also.

One of the most dramatic fields of science is elementary particle physics. I will assume everyone knows that matter is made up of atoms and molecules; that atoms are made up of a nucleus consisting of protons and neutrons and that the nucleus is surrounded by a 'solar system' of orbitting electrons. It turns out that that is far from the end of the story. What holds the protons and neutrons in the nucleus together? The answer is that a new kind of force is involved which operates through the exchange of an intermediate particle calle a meson as shown in figure 1.

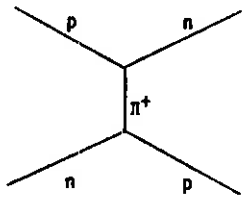

Figure 1.

These particles have very short lives, but their 'trails' can be seen if they are blasted out of the nucleus in high energy experiments. The most immediately striking feature of this picture is how 'active' matter is at the micro scale. It is nearly empty, and the particles which compose it are in a constant state of flux. (There is an infinite regression of possible exchanges which makes the mathematics of elementary particle physics well-nigh impossible at times because

it gives infinite answers; but this has been solved for most cases by a process known as renormalisation.) There also turns out to be a large family of particles and indeed the family is so large that it created first a taxonomic problem and then a need for the development of new theory to explain the structure of the family. Intriguingly, this family structure has been explained, hypothetically at least, by postulating that most of the elementary particles currently known are not in fact elementary. They are made up of yet more elementary particles known as quarks. These are held together by an even shorter range strong force brought about by the exchange of yet another kind of particle called a gluon.

This is reductionist science at the extreme. Is there any further to go? And there are also complex questions of meaning to be tackled arising from the uncertainty principle, the duality of waves and particles (all particles at times behave like waves and vice versa) and the constant flux already referred to which makes it difficult to say what, ultimately, is elementary. Chew even introduced the notion of particle 'democracy', saying that none were fundamentally elementary.

For our second example, we go to the biggest possible scale and ask questions about the nature of the universe. It has long been known that parts of the universe are in motion relative to each other, and there have been two major theories proposed as explanations. The first of these assumes that matter is being created continuously; the second, that at some primaeval time, there was a 'big bang', the consequences of which we have been 'observing' ever since. I have never found either theory particularly satisfying. The first seemed too implausible compared to what we know of the rest of physics. If you believe in the second, you are then open to the question: what was the nature of the universe before the big bang. Anyway, the accumulation of evidence now supports the big bang theory, and so, for the present at least, we have to live with that question about pre-bang times.

I say 'for the present' because there is always the possibility of dramatic advances. This can be illustrated by the concept of 'black holes'. We know from our knowledge of gravity that masses attract each other. In particular, the elements of a single mass attract each other. Above a critical mass for the object as a whole (say for a star), the forces become so great that the object starts to collapse in on itself.

Towards the end of that process, no light can escape so that the result is a black hole which cannot be seen. What happens at the end of such a process? Can that create another universe of some kind?

My third example involves a return to a micro scale and illustrates something about modern chemistry or, more precisely, molecular biology. Atoms are held together in molecules by 'bonds' which arise from the sharing of electrons in the outer shells of the atoms. Organic molecules can be very large indeed (though still sub-microscopic - they cannot be 'seen'). Their structures can only be inferred from photographs of the diffraction patterns of X-rays which are passed through them. Through this painstaking process, the structure of DNA - the molecules of all our genes (plants or animals) - was discovered by Crick and Watson in 1953.

They showed that DNA had a double helix structure and that each strand was made up of strings of nucleotides, of which there are four kinds. The 'order' of the nucleotides in a strand of DNA is the coded language which determines how the organism will grow and function. Every cell of an organism has a copy of its DNA, and so this raised the interesting question of how it is replicated as cells divided during the growth of the organism. The answer, or at least a rough sketch of it, is shown in figure 2. The DNA separates into individual strands. Each nucleotide then attracts another of the four- but always a corresponding type. This leads to two new lots of doubly-stranded DNA which is available for cell division.

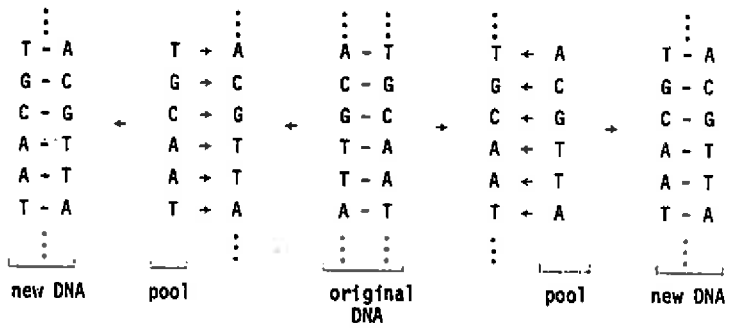

Figure 2.

This kind of discovery is spectacular to observe and to try to understand. But there are some different kinds of points worth remarking on. It is one of the few cases in modern science where there is an informal documentation of the discovery: Watson's book *The double helix*. And it also exposes as a consequence what is *not* known in modern science. Relatively little is understood, for example, about the nature of the 'language' encoded by the nucleotides. And almost nothing is known about how DNA programmes the development of an embryo. How does a particular cell, for example, 'find out' that it is going to be on the end of a finger?

Finally, we look briefly at some of the current questions associated with the theory of evolution. This, you will recall, is based on Darwin's idea of the survival of the fittest and is built on the possibility of random change and adaptation. Molecular biology obviously adds something to this picture. The random change is likely to be a mutation in the gene structure. Part of the problem now, is to explain the evolution of DNA.

It is likely that the broad elements of Darwin's theory will survive. However, it is now being argued that there are weaknesses in it which need further consideration. For example, given estimates of the age of the earth, the Darwinian processes do not seem *fast enough* to generate a species as complex as *homo sapiens*. Further, there are significant gaps in the fossil record so that a theory of continuous change cannot be sustained without explaining these. It is now being conjectured that there have been elements of discrete change in the whole process. And this may be linked to ideas of systems theory: that it is important to recognise the effect of, and to investigate the mechanism for, the creation of new orders of 'organisation' in a hierarchy.

5. Individuals and societies

In the case of the so-called hard sciences above, we have seen examples which illustrate the nature of theory, and we can imagine, at least, ways in which such theory can be tested. Intuitively, and with all the qualifications that modern philosophy of science will throw at us, we could, given the time, weigh the evidence and decide on the degree of credibility we give the various theories. The answer in

most cases would be: rather a lot. In the case of the social sciences and the arts, this kind of assessment is very much harder. Hudson, in the article cited earlier[6], puts this point elegantly when he writes

> "... certain intellectual activities have, built into them, a species of rachet: a guarantee of publicly recognisable progress. To the outside eye, at least, mathematics, the established sciences, technology, all seem to enjoy this advantage. ... Elsewhere, analytically speaking, the going becomes altogether stickier; acknowledgement is much more a recognition that a new sort of story is being told."

Or the same story in a different language, with more depth?

I wouldn't be as hard on the 'soft' sciences as Hudson is here, but there may be a difference in degree if not in kind. In the examples which follow, we lay stress on alternative theories and the difficulty of finding evidence which will distinguish them. It is in this sense that aspects of social science are harder than corresponding aspects of hard science. I will start by taking human psychology as an example and will follow this with examples from economics and sociology. I will then turn to the novel, and corresponding aspects of literary criticism as an example of an art form.

The root of human psychology is the understanding of behaviour and motivation. A number of competing theories are on offer. As amateurs, we perhaps think first of Freud and the apparatus of ego, id and superego which he postulated as units of explanation. The id represents our basic subconscious drives which Freud hypothesises to be sexual and erotic on the one hand and aggressive and death-seeking on the other. The superego is a set of constraints and inhibitions; and the ego is the conscious 'decider'. Add to this picture the concept of 'libidinal energy' and the assumption that we have a fixed budget of it, and it is possible to begin to work out some of the consequences of Freud's theory. Freud himself of course did this in great detail. This leads to two immediate observations. First, it is possible that the observations of practising psychologists could be compatible with Freud's theory without that actually confirming the theory. Indeed, it is a matter of controversy as to whether Freud's theory is verifiable at all; and one of the books on the reading list (Farrell's) is concerned with this issue. Secondly, and notwithstanding the previous comment, it is possible that Freud was accurate in his observation in such a way that his theory contains some degree of truth even if the underpinning

concepts appear rather bizarre. It would then be possible, in principle, to translate the theory into more plausible and viable forms.

But the story does not end there. There are, of course, many competing theories. Adler, for example, emphasises environmental influences and inter-personal relations and sees motivation in terms of attempts to overcome superiority; or the drive for power. Jung extends the theory of the unconscious to include a collective memory - his 'archetypes'. Fromm's theory is based on our desire to escape from loneliness. Then there is the sharp distinction between psychology and psychiatry. The latter is medical-based, and its underpinning theory follows the philosophy of pure science. It can be argued that it follows this in a field which isn't necessarily suited to it (when so many fundamental problems are unsolved). This leads to a behavioural approach - a 'block box' approach: the modification of behaviour through treatment, the detailed effects of which are not understood. In this case, therefore, different beliefs about theory and truth lead to very different treatments, the difference, in some cases, between therapy on the one hand and drugs and electric shocks on the other: the competing beliefs of professionals.

Let us now progress to the 'social' scale. Individuals interact with other individuals. Groups form; organisations form; other categories can be identified even though they are not formally organisations. Society provides the backcloth for individual choice and decision; or indeed it imposes constraints to such an extent that there is relatively little choice. The basic data of social science is obviously immensely complex; such regularities and laws as might be discovered might be open to transformation in the future in a way which is not true of physics and chemistry say. But this opens up a higher order task: to seek to explain and to understand such transformations. Here, in part, lies the response to Hudson's argument cited above: this higher order task makes social science more subtle, more difficult, more interesting, but not necessarily a different kind of animal.

As in the case of psychology, there is no agreement about a comprehensive underpinning theory. Two examples will illustrate the difficulties.

The first is taken from economics - the 'queen' of the social sciences, the most developed. The current orthodoxy goes under the name of neo-classical economics. It is based on the idea of individuals choosing what they do and buy to maximise their preferences and suppliers maximising their profits. The driving force is population growth and technological change. The state is a pluralist one, acting as arbiter when interests conflict, tackling market imperfections, and so on. Even within this paradigm, however, it turns out that there is no detailed agreement. The Nobel prize can be awarded to a monetarist one year and to a Keynesian the next.

There is also an alternative paradigm: the Marxist one. This replaces the essentially micro-scale voluntarist assumptions of neo-classicalism with macro assumptions of a dynamic based on class struggle, with development being determined by the economic base on which is erected a social and political superstructure which supports it. The state, in this paradigm, is in some form or other a supporter of capital.

Again, there are some practical consequences dependent on one's beliefs. Now, however, I can only cite it as an interesting example to be studied, and to emphasise that the received wisdom of a particular school should not be accepted as truth. Life will turn out to be more complicated than what you have been told on any particular occasion. The reading list again offers the beginnings of a basis for personal reading and evaluation.

A more easily intelligible example, but nonetheless striking one, is offered by a consideration of the role of women in society. The feminist movement has drawn our attention to the unequal treatment of women stemming from an acceptance of stereotypical pictures of women's roles, of ideas of 'naturalness'; neither of which stands up to analysis. Indeed, it can be shown that social scientists, in spite of claims to scientific objectivity, have been as guilty as society at large in perpetuating myths by failing to represent adequately, failing to analyse, the position of women. By failing to differentiate between sex and gender. Failing to recognise that women's roles are determined by a view of gender which is socially rather than biologically determined. Understanding will improve as this is realised. It remains an open question as to what extent improved understanding will bring about social

change. (It can be argued that the increased understanding of the role of social class in determining the distribution of income has not proceeded very far in removing corresponding inequalities.)

In summary, and based on a number of examples which is far too small, it can be said that a lot of valuable knowledge is generated within social science - certainly at a descriptive level. It may be the case that there are theories and models which work for the short run. (Indeed, it can be remarked that much theory in human geography can be located here.) For the long run - perhaps indeed for history also - we do not have adequate theories. Deeper, and agreed, theories seem to be a long way away.

As a final example, I want to consider a different kind of knowledge about individuals and society: that represented in novels. At first sight one might argue that 'fiction' cannot offer what we want: it cannot represent 'truth'. But consider as a loose but useful argument the saying that 'truth is stranger than fiction'. Why? Because the novelist, much of the time, is portraying society as he or she sees it. The product *is* representative and in that sense often offers more insight into 'truth' than a more formal scientific process (or the oddities of reality). Liam Hudson argues this point explicitly in relation to psychology and literature: there can be more relevant material in a novel than in the analysis of the performance of rats in mazes(6).

Fiction has many roles: for example, aesthetic pleasure, or as a medium of social communication (offering reassurance or sharing emotion). But here I am concerned with it as a code for representing knowledge about society. The novelist has one very large advantage over the social scientist: he or she can draw on the experience of the reader (and, ultimately, of course, further extend that experience). There are difficulties with this. Although the writer has all the nuances of language at his or her disposal, the reader may not interpret material in exactly the way intended; but there is a beneficial converse too as the reader may add interpretations which are useful. In the end, the difficulties disappear in a consensus about what the novel means.

It is for this kind of reason that, in my general reading list, I offer more novels than books in any other single category. They are each chosen because they say something about a particular society at a

particular time. I have preceded this with a number of books on 'literary criticism' - a term which is to be interpreted as concerned with the elucidation and evaluation of literature. More recently, literary critics have started to go beyond interpretation towards broader theory. What has become known as the Cambridge structuralism debate is part of this, and I have added a book or two which will take readers in that direction. That is also a convenient point to bring my own argument full circle because to decipher that debate, to make one's own decisions and form one's own opinions, involves an excursion back into philosophy and linguistics as well as into literature. The effortis instructive and illustrates well the kind of thing I have been trying to argue as a whole.

I will end this section with one illustration of how dipping into the literature of liteary criticism has offered me some new insights; and I will let the novels speak for themselves. The example comes from David Lodge's lecture(7), 'Modernism, antimodernism and post-modernism'. The antimodernism writer is the realist; the modernists (Joyce, Conrad and Laurence are cited as early examples) are such that

> "the effort to capture reality in narrative fiction, pursued with a certain degree of intensity, brings the writer out on the other side of realism".

Such writers are seen as

> "pursuing reality out of the daylight world of empirical common sense into the individuals consciousness, a sub-conscious and ultimately the collective unconscious, discarding the traditional narrative structures of chronological succession ..."

and so on. 'Art imitates life' (realist) set against 'life imitating art' (modernist).

This straightforward analysis offered me new insights into my own reading. It explained my 'taste': for the realist novel; for the novelist as social scientist. But it also allows me to approach, with more understanding, modernist literature for the first time.

6. Concluding comments

Can I, as I reach the end of my own examples and invite the reader to start reading, offer any new justification? In the examples, I have focussed on substantive (system-of-interest) topics which function mainly at the level of satisfying curiosity. I do not decry the value of this; and indeed, in many cases, in the social sciences, literature and politics for example, the knowledge gained can enhance and enrich the way we live, the way we make our choices, the way we understand our constraints. The deeper usefulness, however, probably lies in feeding our minds with the broad range of methods of approach (and their sociologies and ideologies) of different disciplines. We begin to get a sense of the nature of *complexity* in different fields of study and that its resolution, the search for understanding, needs different kinds of hard thought - the application, sometimes in novel combinations, of different kinds of methods.

To derive the deeper benefits, therefore, if there are any, involves taking the argument further. From substantive systems in physics, chemistry, biology, psychology, economics, sociology, literature and so on, to analyses of how physicists think, how sociologists think, what their methods are, and how they deploy them. I will present my own analyses and arguments elsewhere. For all of us as students, some basic wide-ranging reading is a necessary preliminary. The future stages could be very exciting.

Notes

(1) This argument, and the quotation below, is from W.I.B. Beveridge (1950) *The art of scientific investigation*, Heinemann, London. He has also recently written a sequel: W.I.B. Beveridge (1980) *Seeds of discovery*, Heinemann, London.

(2) Liam Hudson (1980) The octopus, the telephone exchange and the ivory tower, *The Times Higher Education Supplement*, 26 September, p. 11.

(3) My own work on 'entropy-maximising' models in geography stemmed from two elements of chance: first that I read mathematics and secondly that within the course, I had thoroughly enjoyed the lectures on statistical mechanics. Another odd juxtaposition is Stafford Beer's use of the central nervous system as an analogy for any kind of organisation in *Brain of the firm* (which is on the reading list in the Appendix).

(4) C.P. Snow (1959) *The two cultures and the scientific revolution*, Cambridge University Press, Cambridge.

(5) C.P. Snow (1963) The two cultures: a second look, *Times Literary Supplement*.

(6) L. Hudson (1980) Language, truth and psychology, in L. Michaels and C. Ricks (Eds.) *The state of the language*, University of California Press, Berkeley.

(7) D. Lodge (1981) Modernism, antimodernism and postmodernism, in *Working with structuralism*, Routledge and Kegan Paul, London.

APPENDIX

A reading list

Reference

A. Bullock and O. Stallybrass (eds.) (1979) *The Fontana dictionary of modern thought*, Fontana, London.

R. Fowler (ed.) (1973) *A dictionary of modern critical terms*, Routledge and Kegan Paul, London.

R. Williams (1976) *Keywords*, Fontana, London.

2. Knowledge and its creation: philosophical and methodological issues

2.1 Introduction

B. Russell (1946) *A history of western philosophy*, Allen and Unwin, London.

2.2 Theories of knowledge: questions and trends

B. Russell (1948) *Human knowledge*, Allen and Unwin, London.

D.W. Hamlyn (1970) *The theory of knowledge*, Macmillan, London.

2.3 Traditional philosophies of science

K.R. Popper (1959) *The logic of scientific discovery*, Hutchinson, London.

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