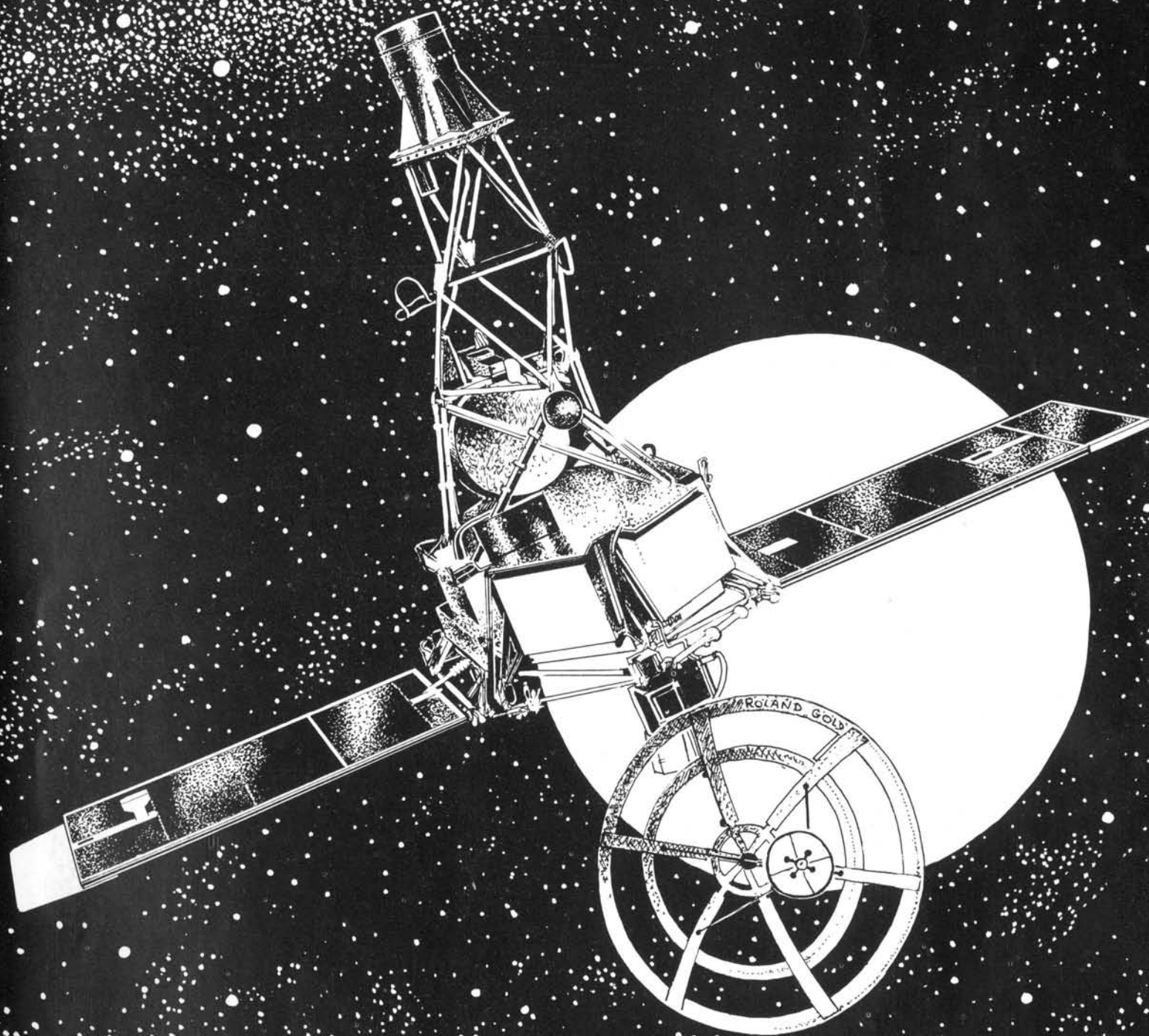


The
Ecologist

Journal of the Post Industrial Age

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Is Science a Religion? by E. Goldsmith

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Owing to the recently announced increases in postal charges we are once again forced to raise the price of The Ecologist. From the next issue (March/April) the rates will be as follows: Annual subscription £5.50. (U.S. \$14.50) Special rate (see subscription coupon on Page 41) £5.00. Students £4.50.

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Ecologist, Vol. 5, No. 2

The second report of the Club of Rome has appeared. It is the work of thirty scientists, who specialise in different aspects of the world's problems, headed by Professor Eduard Pestel of the Institute of Technology at Hanover, and Professor Mihajlo Mesarovic, Director of the Centre for Systems Analysis at Case Western Reserve University.

The general feeling communicated by this study is that we are much closer to the crunch than Meadows let us suppose in the first Club of Rome Report. Indeed, unless radical action is taken on a number of fronts the situation by the end of the century will have become completely out of control.

In South Asia, for instance, by the year 2000 there will be an extra 390 people to feed from every square kilometre of arable land. With the protein deficit for this area increasing at a rate of 50 million tons a year — and this is the most optimistic figure — the amount of food which would have to be imported to avoid massive starvation would be considerably more than the total likely to be made available to the world as a whole by the exporting countries, several times more than could be financed by exports and more than the world's transport systems could conceivably accommodate.

Nor is there any hope of providing the basic amenities which would be required by the exploding urban population. Consider that every week sees the arrival of 350,000 new people in the already hideously congested cities of South Asia. This figure is likely to increase to 750,000 by the end of the century, by which time Calcutta will have a population of 60 million.

To make matters worse, the amount of energy available to produce food and provide urban amenities would have long since ceased to keep up with demand. By then, the world's oil reserves will have been exhausted, and we shall have become dependent on nuclear power.

In order to generate the forty million kilowatts of electricity required, we would need 24,000 nuclear reactors (assuming they function at 40% capacity). This would mean putting up four new ones a week for the next hundred years. Since they only last thirty years, we would have to build two a day just to replace those which we are forced to abandon.

These alone would cost two thousand billion dollars a year, which equals 60% of the World's income. Even were this conceivable, the dangers involved would be insupportable. Consider that fifteen million kilogrammes of plutonium 239 would have to be produced and transported every year. This is one of the most toxic substances known, and has a half-life of 24,000 years. The inhalation of one millionth of a gramme is sufficient to induce lung cancer, which means that a quantity of plutonium the size of a grapefruit would suffice to kill the entire population of the world.

The notion that nuclear power could be dispensed with in favour of solar power is chimeric. To produce the equivalent of 200 million barrels of oil would require covering approximately one per cent of the surface of the earth with solar collectors at a cost of between 20,000 and 50,000 billion dollars at today's prices.

Clearly all these trends must be reversed, and there is no time to lose, but how? To find the answer one must consult the computer — which is referred to throughout this study as a modern version of the Delphic Oracle.

The model is supposed to be superior to the Meadow's model in that the world is not regarded as a single unit, but as made up of a number of different regions whose problems are not necessarily the same. In practice two differences emerge: some export oil, others import it, some are poor, others are rich.

The computer assumes that economic growth is a good thing and that it can actually solve human problems, whereas all available evidence, both theoretical and empirical points to the opposite conclusion.

The computer works on the premise that our problems are not caused by growth per se, but by a particular type of growth,

which is referred to as 'undifferentiated'. Another type of growth referred to as 'organic' does not cause problems, on the contrary it helps solve them.

The distinction is a key one, though the term 'differentiated' would be better than 'organic' since it is not only in organisms that such growth occurs, but in all natural systems including cells, societies and ecosystems. For several million years, human societies have fulfilled their specific functions as differentiated parts of the world's ecosystems as do other animal societies.

To suggest that economic growth can be 'differentiated' or 'organic' is simply to play with words. It is pseudo-science at its worst. Economic growth whether it occurs in rich or poor countries, constitutes, from the point of view of the biosphere of which man is part, undifferentiated growth, randomness or entropy.

The solutions the computer has to offer are the same pious exhortations to do things, which, whether they are useful or not, will quite evidently never be done. Thus the rich must provide more aid to the poor. There must be more global cooperation. We must abandon the notion of national sovereignty. We must identify ourselves with future generations, etc.

The computer does not suggest how these *tours de force* are to be achieved. It does not consider that as galloping inflation makes the rich countries increasingly poor, they will be willing to provide *less* rather than *more* aid to the poorer ones, that as international stresses over resource shortages build up so will people become *more* rather than *less* nationalistic, and that once our very survival is at stake our concern with our own immediate problems will be such that we shall become still more indifferent to the lot of future generations.

At this point, we might well ask why the Club of Rome is failing to come out with any answers. One reason is that they have grossly overestimated the value of computers. They really seem to believe that these big clumsy adding machines can come up with answers which human brains cannot produce.

I am not suggesting that computers do not have their use. They force one to divert from what today passes for scientific method and to build models rather than look at things in test tubes. They force one thereby to face the assumptions on which conclusions are based and to quantify the variables used. Unfortunately this is, at present, a disadvantage rather than an advantage, since the most important factors determining the future of man on this planet — I refer to human values — have not yet been quantified.

The dichotomy between facts and values is one of the Myths of Modern Science which most requires exploding. The two most important principles of the New Science which we so badly need is firstly that behaviour at all levels of organisation is goal-directed, and secondly that the goal is 'stability' or in the narrowest sense of the term: survival.

Values are simply the basic principles underlying a society's world view on the basis of which its behaviour is mediated. *They can thereby be judged objectively in terms of the extent to which they favour the achievement of stability.*

This brings us to the crux of the matter. *The assumptions underlying this model simply reflect the basic values of Industrialism*, and thereby provide a justification for industrialisation, but cannot provide one for the opposite process of deindustrialisation — which is quite evidently the only possible strategy for tomorrow. Unfortunately, computers cannot modify the assumptions underlying the models which they contain.

It is not to the computers of the Club of Rome that we must look for a Strategy for Tomorrow — but to a group of creative thinkers, who are capable of examining our problems not just in terms of the aberrant values of Industrialism, but objectively in their evolutionary context.

Edward Goldsmith.



SWALEDAL RAM

The Value of Rare Breeds

G.L.H. ALDERSON

Illustrations by V Hutchings



LONGWOOL

Indigenous breeds of farm livestock are those best able to convert the natural vegetation of their habitat. The preservation of these rare breeds is neither whimsical nor sentimental, but is a vital link in the effort farmers must make to produce meat without recourse to cereal feeding stuffs.

The British Isles are populated by sixty different breeds of sheep varying from the small primitive Soay of the Outer Hebrides to the massive and ponderous longwools of South-West England. Many times in the past scientists, working on theoretical models, have suggested that the national flock should be rationalised and based on only six or seven breeds. This would seem a perfectly plausible plan, especially with regard to greater standardisation of the end product, but experience has shown that in practice there are very good reasons for retaining our wide variety of breeds.

Each breed has evolved in a specific environment which is a combination of three factors, namely climate, land type and management system. The main argument for reducing the number of breeds vastly oversimplifies these factors. It is claimed, for example, that in the mountains of Great Britain the relatively high performance of Swaledales and Cheviots should enable them to replace the other mountain breeds. In some countries scientific opinion on this point has prevailed, and Government policy has forcibly amalgamated groups of breeds into one amorphous mass, losing valuable characteristics in the process and storing up problems for the future. A more detailed

analysis of Britain's mountain sheep will illustrate this situation very well.

While all the mountain and hill breeds are adapted to tolerate an inclement climate within the context of a reasonably standard management system, they have evolved on very different geological formations and types of vegetation, and this is one basic reason why so many breeds have persisted.

Mountain grazings in Scotland are based mainly on Pre-Cambrian rocks; those in the North of England on limestone; and those in Wales on shale. The herbage is of two main types described as "black moor", which is mainly heather, ling and cotton-grass, or "white moor", which is mainly nardus and molinia grasses. The Swaledale inhabits the black moor areas of the limestone Pennines, while the Cheviot lives on the shales and grazes the white moor. On the other hand the Scotch Blackface lives on the granite based Scottish Highlands, while the territory of its close relative, the Rough Fell, is a small outcrop in the middle of the Swaledale stronghold. Each breed has adjusted itself to the particular combinations of conditions in which it has evolved, probably by slight physiological changes, and any attempts to establish the Swaledale in the Rough

Fell area in the past have always failed.

In certain circumstances some breeds have adapted themselves to very unusual conditions. Both the North Ronaldsay sheep in the Orkney Islands and the Cladore sheep off the west coast of Ireland are able to tolerate a diet of seaweed, having been restricted to the sea-shore in their native islands. In these cases the physiology of the sheep has become modified significantly to cope with the unorthodox diet. The blood and milk contain very high levels of urea and iodine as a normal feature of these breeds. The short-tailed sheep of northern Europe, living in an area of sparse vegetation, were forced to extend their diet to a wider range of material, and sheep with as little as 12½ per cent short-tailed blood in their veins still show a predilection for browsing, despite being herded in modern intensive grassland systems with easy access to high quality herbage.

Thus each breed has its own particular ecological niche. This is most obviously illustrated in the hills where the influence of man has exerted the least effect. In the lowlands the greater use of artificial aids has masked the natural conditions, so that the delicate balance between the animals and their environment has broken down. Since animals were first domesticated man has interfered with their ability to survive in their indigenous environment. In his constant search for higher production he has selected the sheep with the highest quality wool, the fastest growth rate, and the greatest prolificacy. To do this he needed to create a more favourable environment by giving more detailed attention and using more



WHITE PARK BULL

fertiliser and concentrate feed. This proved to be a vicious circle as the animals lost their native hardiness and thriftiness, and eventually it was necessary to provide housing to protect them. Increasing interference by man encouraged domestic animals to evolve away from their natural instincts, so that although modern lowland sheep may be very prolific and carry a high proportion of edible meat, their ability to achieve a successful unassisted parturition or to survive in difficult conditions has been seriously impaired.

The striving for higher productivity from domestic animals was accompanied by high levels of inputs designed to increase production. High input/high output systems have been a favourite theme for agricultural economists, and in some circumstances they can show to great advantage. But in recent years rampant inflation has placed any high cost system under great stress and many are now at breaking point. Table 1 illustrates this using an example from dairy cows. Cow A yields only 950 gallons per lactation and requires 3lbs. of concentrate feed for every gallon she produces. Cow B produces 1,200 gallons but needs 4lbs. feed per gallon. Under normal circumstances Cow B achieves a higher profit, but when costs escalate as they have done in 1973 and 1974, the position is reversed.

With the aid of modern technology it is possible for farming systems to develop so rapidly in any given direction, that the abrupt check resulting from the present economic situation has provided a vital opportunity to re-assess the validity of the direction of our progress. It is an appropriate time for man to stop working against natural forces and instead to pull in harmony with them. Systems of self-sufficiency and organic farming in the past have been considered the outposts of agricultural eccentricity, but quite suddenly they have acquired an air of respectability. The reason is the changing pattern of economic forces, and the livestock industry also will need to adjust itself. There will be an increasing demand for "easy management"



SOAY RAM

animals, and it is in this context that various breeds which have long since ceased to occupy a recognised place in the national flock or herd, may once again achieve prominence.

Many of these rare breeds have been by-passed by the enormous changes that have taken place in the late nineteenth and twentieth centuries. They have continued to evolve as an integral part of a relatively unsophisticated environment. They exhibit considerable disease resistant qualities; they have strong maternal instincts; and they can thrive on poor quality feed.

If livestock farmers could be weaned away from the bosom of fashion, and base their judgement instead on current commercial criteria, they would discover that in some areas in some conditions rare breeds should take precedence over the more popular breeds of the present day — the Kerry cow over the Friesian; White Park cattle over Hereford cattle; Soay sheep over the Clun Forest; and the Tamworth pig over the Large White.

The Rare Breeds Survival Trust is concerned closely with these four breeds. The Trust recognises the importance of the link between the characteristics of a breed and the environment in which it evolved. Whenever a breed becomes extinct its particular characteristics are lost and valuable genetic resources are denied to posterity. Some twenty

breeds have become extinct in Great Britain since the Second World War, and the Trust needs the support of as wide a public as possible to prevent any further depletion of our national heritage. The first priority of the Trust is to establish new breeding units of rare breeds, but its second aim is to establish those units in areas where the special features of the breed can find full expression in a sympathetic environment.

Many rare breeds have survived so far either because they were located in isolated areas which reacted only slowly to change, or because they needed minimal attention and thus represented the line of least resistance. Now this latter characteristic can be turned to advantage, and sheep, cattle or pigs which do not rely on human assistance are becoming the focus of new easy management systems. The Chillingham cattle form the most notable herd of White Park cattle and exhibit the extreme characteristics of this breed. Calving troubles are virtually unknown; diseases such as mastitis, brucellosis and hypomagnesaemia do not occur; and there is little evidence of internal parasites although the animals have never received an anthelmintic. The Chillingham herd has been a closed, inbred unit for more than seven centuries, enclosed within the same park for the whole of that time. It is clear that these animals have achieved a compatibility with their environment which is incomprehensible to the majority of modern livestock farmers who shelter behind a protective barrier of drugs and vaccines. But such protection is far from complete, and new strains of bacteria and virus, often resistant to current chemotherapy, are breaching the defences at an increasing rate.

Breeders of cereals are already

TABLE 1	Normal cost structure		Inflated costs	
	Cow A	Cow B	Cow A	Cow B
Yield of milk (gallons)	950	1200	950	1200
Cost of concentrate feed	£ 55	94	100	171
Profit per cow	£ 25	39	14	5

learning this lesson, so that the genetics of plant breeding seems now to be based on producing new varieties of a cereals at a greater rate than new strains of disease overwhelm them. There is only one result in such a race, and the geneticist is not the victor. The lesson to learn is that provided by the Chillingham cattle. Maximum production is not necessarily the most profitable or most desirable. There is increasing evidence to suggest that the most efficient production and utilisation of resources may be achieved by emphasising much more an established relationship between a breed and its environment, rather than by importing exotic animals which have exhibited a particular production characteristic at a high level under entirely different conditions.

In recent years the combination of short-term financial speculation and genetic novelty has brought a spate of exotic animals into Great Britain, and further endangered the survival of several native minority breeds. The Rare Breeds Survival Trust is committed to the preservation of these breeds so that, when the current flood of imports has abated, they will be available to contribute their special qualities as an integral part of the agricultural ecology of this country.

THE TREE COUNCIL

The TREE COUNCIL are to hold an annual NATIONAL TREE WEEK. This year it will run from March 9th-16th.

The Tree Council's work is largely carried out through its links with 20 national bodies represented on it (including the Civic Trust, C.P.R.E., N.F.U., National Trust and Local Authority, tree, forestry and growers organisations). It is backed by a modest grant from the Government and is seeking Charity status.

NATIONAL TREE WEEK is intended to highlight the work of The Tree Council. The principal activities planned this year will concentrate on TREE PLANTING, information to the public on the proper care and maintenance of trees and the launching of an ambitious programme — which may take several years to complete — to survey the Nation's trees in non-forest areas.

Further information may be obtained from:
Sydney Chapman, Director, National Tree Week,
Room C 10/13, 2, Marsham Street, London SW1P 3EB.

Telephone: 01-212-7484.

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Some Observations on the Australian Environmental Scene

By PETER SPRINGELL.

Most people would assume that it is only small overpopulated and overindustrialised countries which have environmental problems. This is not so. Our way of life is so destructive that even Australia, with its massive land area and relatively small population, has serious environmental problems. The time lag between events taking place in Australia and in other developed countries could and should provide Australia with a unique opportunity to avoid some of the mistakes of others.

The fact that Australia's per capita GNP¹ of £1,730 places her among the world's 10 richest countries, does not deter the establishment from loudly proclaiming at every opportunity that the country is "underdeveloped". The masses have been brainwashed into believing that there is an everpressing need for "development", although "exploitation" would be more descriptive. Consequently, the States are collectively falling over backwards to attract more development. There is much inter-State rivalry, as each State wishes to outdo the others. The would-be exploiter is in the happy position of being able to play one State off against another. Industry is lured by various incentives, including the lowering of environmental standards. The State of Queensland (or the "deep north" as it is often described by southerners), which is particularly aggressive about "getting on" in the world because it is in the hands of an ultra-conservative bunch of politicians, for instance has a very comprehensive Clean Waters Act. The trouble is that all the biggest polluters are exempt from its provisions.²

History of urbanization

Australia was first colonized because England had to find somewhere to send her convicts after the American colonies gained their independence in the late 18th century. Early

settlement centred around Sydney at first, and around other harbours later. The early settlers were almost entirely dependent on supplies of all kinds from the "mother country" and elsewhere by sea, so naturally most development took place near the point of entry of goods. Subsequently, exports of agricultural produce were also channelled through these ports. To this day most business, industrial and administrative activity is concentrated in the same cities, particularly in Sydney and Melbourne.

The east coast has become the most populated part of the continent, because the rainfall and climatic conditions generally¹ render the interior and the west coast relatively inhospitable. Indeed, Australia is now one of the most urbanized countries in the world, with 86 per cent of her population classed as urban.³ Sydney and Melbourne are the only two cities of over 1 million inhabitants, but between them they hold 40 per cent of Australia's population, thereby packing them into only 0.15 per cent of the area of the continent.

Decentralization has been an insincere catch-cry for many a year now, but there are indications that the newly created Ministry of Urban and Regional Development really means business.⁴ The proposal is to build new centres, of which Albury/Wodonga (also popularly known as "Whitlamabad", after the Prime

Minister Mr. Whitlam) on the Murray River, would be the first. Perhaps this was an unfortunate first choice, as much red tape will inevitably ensue with the Federal and 2 State Governments involved. Already there is a dispute as to what the maximal population of this centre should be in view of the expected increase in pollution of the Murray River. The principle of the idea would perhaps not be a bad one, if limits were placed on the size of Sydney and Melbourne, with the overflow earmarked for the new growth centres such as Albury/Wodonga. However, no such limits are proposed or contemplated. Without such controls it seems inevitable, for instance, that Newcastle, Sydney and Woollongong will eventually merge into one ghastly megalopolis. In the meantime, it is belatedly being recognised, at least in some quarters, that there is a very urgent need to provide more adequate recreation areas within reasonable distances of big cities.⁵

Political scene

It is not surprising that urban problems rate high on the list of environmental priorities. The Australian Labor Party, which swept into office on the national level towards the end of 1972, did so largely because it accurately sensed the growing discontent of the suburban dwellers. The earlier Liberal-Country Party coalition

Government's pampering of the rural minority and of big business became just too blatantly obvious to the salary and wage earning city voters, who after all make up the majority.

The governing Labour Party is not all for the environment by any means, indeed it is still essentially very much for economic growth. There are less than half a dozen Federal Cabinet Ministers who are sympathetic to the "Limits to Growth" philosophy, but the opposition of the remaining 20 growth men is just too overpowering.

The Australia Party is the only political party which unashamedly espouses the steady-state economy and zero population growth.⁶ It has as yet no voice in Parliament, and indeed it suffered a reverse (in common with all minority parties) in the recent Federal double dissolution. The poor vote was due to a number of factors, but particularly because inflation and foreign ownership emerged as the only major election issues. Had there been the scheduled election of half the Senators only, the chances would have been much better of the Party gaining at least one seat in an otherwise equally divided upper chamber. On the State level, the United Tasmania Party, which was hurriedly convened in a last-ditch effort to save L. Pedder, got quite close to capturing a seat at the last election. Had it done so, it would have held a balance of power, and it would have had an influence far in excess of its voter support. It may well be tempted to try again, and perhaps with more time to organise, it could even have success.

Politics and "green" issues

The outside world is perhaps most familiar with "green" issues such as L. Pedder,^{7,8} the Kangaroo controversy^{9,10} and the Great Barrier Reef issue¹¹; however, there are of course many more.¹² Each of these issues has been bedevilled by constitutional difficulties outlined earlier.

With L. Pedder, the Australian Government proposed a temporary moratorium on the flooding, while alternatives were reconsidered. An



Aboriginal Embassy outside Parliament House Canberra.

Photo Canberra Times.

offer of up to £5.3 million in compensation was made to the Tasmanian Government, as recommended by a special Inquiry.¹³ However, the Tasmanian Government was quite within its rights to insist in proceeding with its pet hydroelectric scheme regardless, despite the Federal Government's offer, which was regarded by most observers as quite generous.

Soon after taking office, the new Australian Attorney-General imposed a ban on the export of kangaroo products in an attempt at conservation. However, the move has been bitterly opposed by some States, particularly by Queensland. It has been claimed, some think quite unjustifiably, that "at no stage in the long history of kangaroo harvesting in Queensland have fears for the survival of the species been substantiated."¹⁴ The State therefore legally sanctions the continued slaughter of kangaroos, but because of the Federal export restrictions, the meat and hide will have to be utilised only within Australia. The Australian Government's initiative can consequently only provide marginal safeguards.

The Great Barrier Reef has been the subject of bitter political controversy, and much politicking. In this era of energy crises, there is considerable temptation to exploit the oil reserves, which are thought to lie under the Reef. Pressure to drill for oil will undoubtedly mount as the energy crisis becomes more acute.

It was only the intervention by Trade Unions, which threatened a "black ban" (a refusal to work on

the project, coupled with a denial of all forms of servicing, transport, etc.), that forced the Queensland Government to institute a Royal Commission into all drilling on the Great Barrier Reef. The Commission, after much deliberation, has come up with a "compromise" as expected and this could mean an end to the Reef as we now know it.

Unfortunately too, it is the Queensland, rather than Australian, Government which controls the reef waters. The Government with this jurisdiction has the capability to control, or even ban oil drilling by insisting on stringent anti-pollution standards. At this point in time, it is the Federal Government which could be relied upon to act more responsibly, and it is therefore unfortunate that the State Government has the upper hand. There is no guarantee that the villain and saint roles of the two Governments might not be reversed at some time in the future.

The whole situation is still very confused. The Inquiry into the National Estate^{14a} recognises the Great Barrier Reef as being of World Heritage standard, and consequently the Australian Government has now agreed to proceed with the Committee's recommendation to have the whole area declared a marine National Park. The passing of the controversial Seas and Submerged Lands Act by the Australian Parliament, following a prolonged battle, would appear to make such a declaration possible, providing the National Park legislation can be passed by a hostile Senate. However, the Queensland Government has

decided to challenge the validity of the Seas and Submerged Lands Act on constitutional grounds, and if the enactment is invalidated, then it is unlikely that the Australian Government would be able to proceed with its plans. Indeed, the Queensland Mines Minister has indicated that the idea of oil drilling on the Reef has by no means been abandoned.^{14b}

Spate of Inquiries

Despite its limited powers (perhaps because of them), Federal Governments have been instrumental in instituting a whole host of Inquiries, Reports and Royal Commissions on such topics as: wildlife conservation¹⁰, air¹⁵ and water¹⁶ pollution, as well as on the National Estate^{14a}. Currently evidence is being gathered on population, on non-returnable containers, and on other topics to which conservationists have contributed, including petroleum and the Australian Public Service. Reports prepared for the previous Government have used much paper, without doing much else. Only time will tell whether the Inquiries launched by the present Government will turn out to be any different. One does already have some apprehensions.

Thus, the Population Inquiry, which was thought of by the previous Government, has remained unaltered in composition. The previous administration had very definite preconceived ideas as to the sort of answers it wanted, and it would be strange if the make-up of the Inquiry were not tailored accordingly. It is essentially a committee of growth men, with no representation from the opposing camp, and with under-representation by biologists and sociologists. At the outset of the Inquiry, the Chairman himself is on record as stating that "the sooner Australia's population can be at least doubled, the better."¹⁷

Trade Union involvement

Much local thinking has been, and still is of the "it can't happen here" variety. Gradually this myth is being shattered, as people are being made painfully aware that Australia's big cities are as polluted as any counterpart of comparable size in Europe

and America. As everywhere else, the motor car has been instrumental in much urban deterioration, with its attendant carbon monoxide,¹⁵ lead¹⁸ and other pollution problems.

Australia has been a late starter in free-way construction, but it is a pity she was not even more "backward", for otherwise many mistakes might have been avoided. Resistance to free-way construction, and to "redevelopment" in general has given birth to a growing urban conservation movement. Recently the movement has become much more formidable, as both the establishment supported National Trust and the Trade Union movement, and particularly the Builders' Laborers Federation, have joined forces with urban action groups. Strikes in support of the urban environment or "green bans", are now a fact of life that no would-be developer can afford to ignore. It is not surprising therefore, that at least one State Government (Queensland) is contemplating legislation to outlaw "green bans", under the guise of a "law and order" issue.

Since their involvement in the Barrier Reef, the Trade Unions have also become interested in other non-urban issues. In particular there has been growing concern over the alienation of beaches by sand mining companies seeking rutile and zircon. Following a recent prolonged battle near Wyong (north of Sydney), conservationists supported by Unions saved a precious red gum forest area from destruction,¹⁹ and in

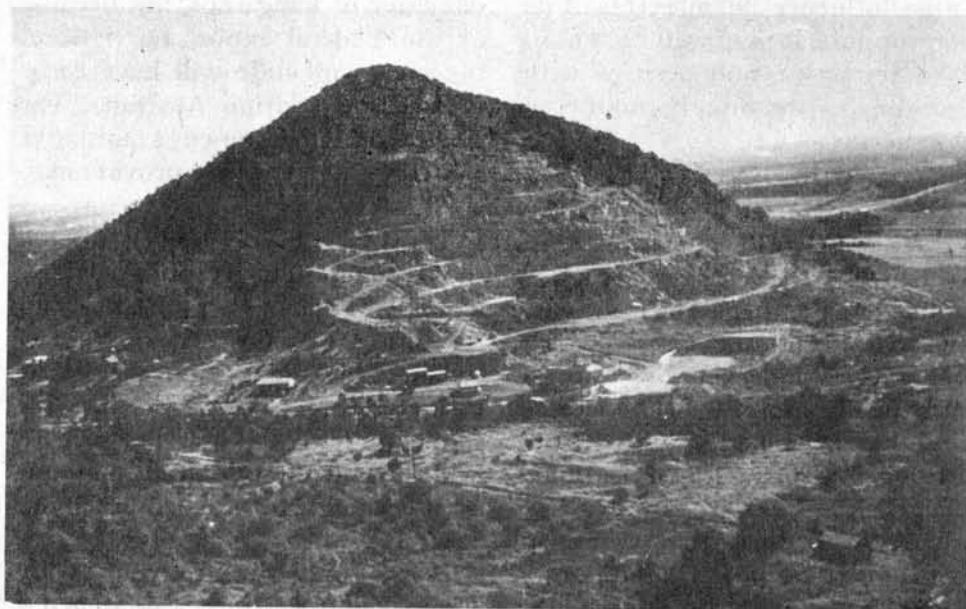
doing so a £700,000 on-site dredge had to be dismantled by the sand mining company in question.

Concern over mining operations has also exposed archaic mining laws,¹² which were drawn up and designed for the 19th century horse and buggy gold-rush days, but which are quite inappropriate today. Landholders have no control over mineral exploration or exploitation activities while mining warden's courts have authority merely to check the legality of lease applications, without regard to land-use considerations.

Areas of land under National Park vary from State to State,¹⁰ and in some instances, notably Queensland, they represent a pitifully small proportion of the land mass. Proclamation of new National Parks is subject to unending delays, until authorities can be absolutely certain that no other possible economic use could be made of the land in question.²⁰ Such delays can of course give would-be exploiters a foot in before valuable areas can be safeguarded. A group of conservationists in North Queensland got so frustrated with the Government that they are circumventing State authorities by raising money to buy the land needed to establish the Quinkan National Park.

Foreign ownership

The devastation wrought by mining interests generally has also helped to focus attention to the fact that most of these enterprises are owned by multinational combines, with



Mount Etna — the worst case of industrial vandalism in Australia.

Photo P. Ladynski.

little or no Australian equity. Australia's obsession to "develop" has in fact proved to be a bonanza for foreign investors of every kind.

Australians are finding that their limited resources, such as beaches, are being alienated by real estate exploiters (foreign and local), so that it is now virtually impossible for the average citizen to afford to purchase a piece of land by the sea. Pensioners, and other financially handicapped groups are being forced out of areas much sought after by developers. The local businessmen have unfortunately been led to believe that this type of "progress" would be financially rewarding to them, when in fact they often end up getting stiff opposition from supermarkets or other more modern shops.

Dangers of mass tourism must also not be overlooked. Too many locals are still being deluded into thinking only of possible short-term financial gains, oblivious to long-term drawbacks, which have become the feature of once-attractive European holiday resorts, now overrun by masses of tourists. Fortunately, the energy crisis may put an end to cheap mass transportation and so save some of the remaining untouched beauty spots in Australia from the ravages of tourism.

Plight of the aborigines

There can be no question that aborigines, who have occupied the continent for thousands of years prior to European settlement, lived in complete harmony with the environment.²¹ It does the white man little credit that it has taken him a mere two centuries to create the ecological mess seen today. The missionaries must take much of the blame for all but wrecking the aboriginal culture by preaching that the white man's ways were superior.

The treatment of the aborigines is indeed a black chapter in Australia's history, and one that has yet to be remedied, for all the fine talk in high places and elsewhere. The failure of the present Australian Government to live up to the high expectations of the aboriginal people is reflected by the fact that it was found necessary to re-establish the "aboriginal embassy" in a tent on

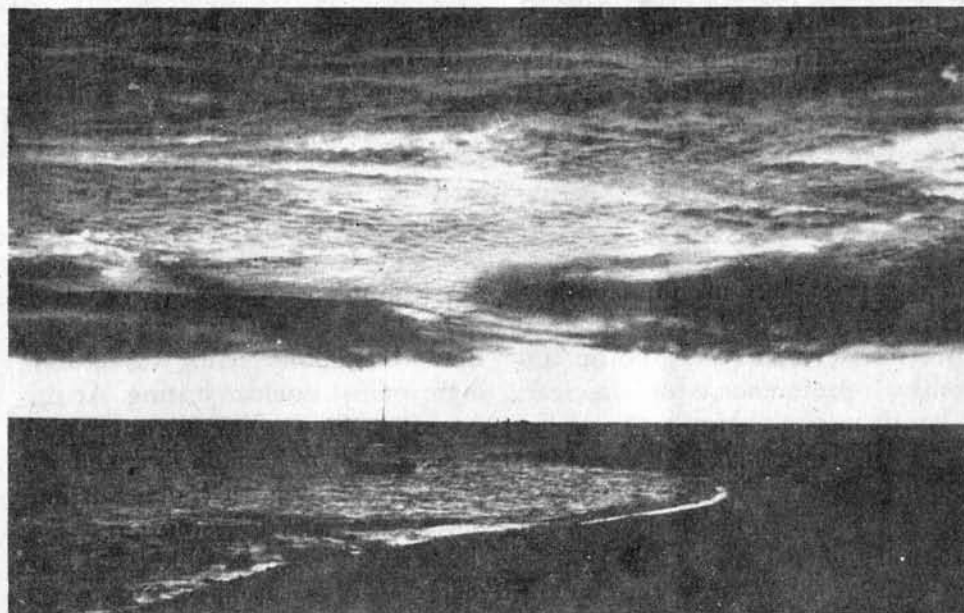
the lawns outside Parliament House in Canberra. It stands there as a constant reminder to politicians of their betrayal of the aborigines.

Possibly one bright spot on the horizon was the announcement by the present Federal Government of its intention to foster the teaching of aboriginal culture and languages to aboriginal schoolchildren. The resurgence of aboriginal culture will be slow, but if successful, it must surely be more effective than the policy of handouts adopted for so long now. Perhaps the recent new life style experiments at Nimbin²² in northern New South Wales were the first admission by the more honest whites that their traditional way of life leaves much to be desired.

instances mistakes of the past have been recognized and remedied, but in other cases bad practices continue.

Australia is fortunate in that she is self-sufficient in food and that she has surpluses which she can export. Unfortunately, such exports do not always find their way to the most needy. For instance, some 97 per cent of beef exports go to the developed countries,²⁵ where people are already overeating, and dying prematurely of heart disease, while hundreds of millions in under-developed countries suffer from protein deficiency.²⁶ Australian's themselves could well benefit by reducing their own meat consumption.

Much Australian agricultural practice depends on dwindling



Barrier Reef . . . pressures to drill for oil will undoubtedly mount"

The rural scene

As in other developed countries, the so-called "improvements" in agricultural efficiency have had the effect of forcing more and more people off the land, and into the already overcrowded cities. One may well ponder how genuine this increased efficiency really is, when one takes into account all the economic and social drawbacks of urban life.²³

There are many examples in Australia of land which has been cleared thoughtlessly, with consequent erosion, and loss of productivity.²⁴ There are examples of marginal land which has been misused, or overstocked. In some

phosphate²⁶ and energy resources.²⁷ Eventual restructuring of agriculture in Australia therefore appears to be inevitable.

Energy considerations

The energy crisis has so far had little effect on Australia. It is true that some of the overseas air line schedules were curtailed, and a number of pleasure cruises cancelled but the average man in the street has hardly been touched.

Australia is at present 70 per cent self-sufficient in petroleum products.²⁸ However, there is only about some 8 years' supply left.²⁹ The chief deficiency at the present time is confined to the heavier

industrial types of oil, and this could interfere with industry, shipping, and therefore with exports of all kinds.

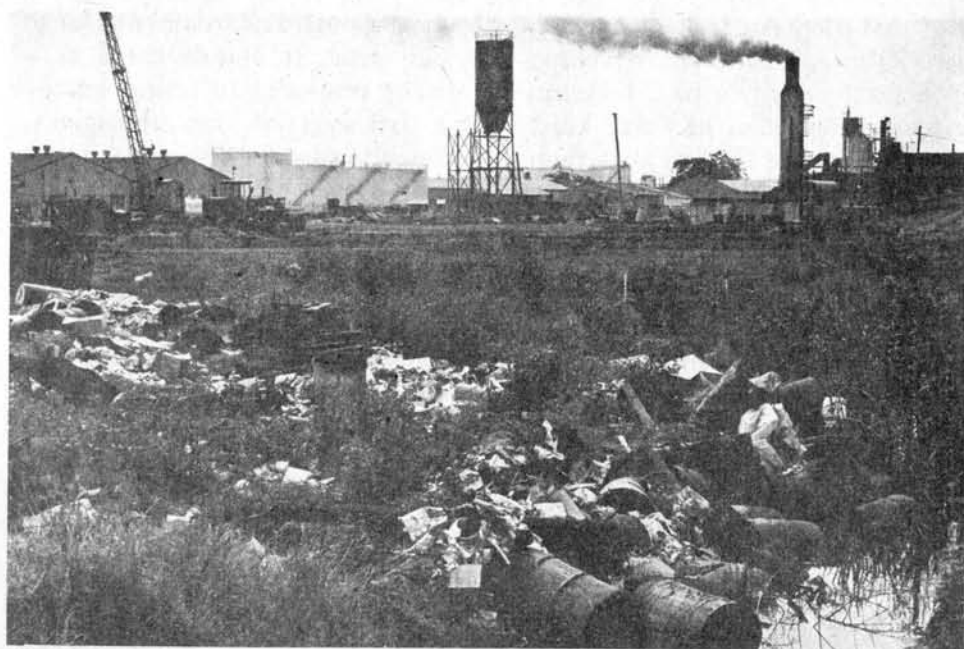
Australia has enough black coal to last perhaps 250 years at the present rate of extraction.²⁸ She also has one quarter of the western world's uranium,³⁰ as well as being excellently situated climatically¹ with regard to solar energy.

There is some talk of converting coal to petroleum, which is reasonable enough, providing Australia acts responsibly in its approach to the global carbon dioxide pattern. In view of the ever-increasing concern over possible climatic,³¹ and ecological³² effects of over-loading the atmosphere with carbon dioxide the time must surely not be far distant when there will have to be rationalization on an international level. The idea that man should try turning the geological clock back to the extent of reverting to the pre-carboniferous era, so distinctly unfavourable to animal life, is unthinkable.

Nuclear tests and uranium enrichment

Unfortunately there is also an unhealthy preference for nuclear, rather than solar energy in Australia, as elsewhere. Indeed, it is the ruling Labour Party's policy³³ "to stimulate nuclear technology", "to establish nuclear power stations" and "to work towards enrichment of uranium". Solar energy does not even get a mention.

For years Australia has harboured a small, but influential nuclear bomb lobby, with tacit approval of the previous Australian Government. If Australia were ever to have its own nuclear deterrent, then it was essential to condition the people to accept the necessity of holding nuclear tests. It was obviously undesirable to portray the French tests as harmful. Consequently, reports^{34,35} by "reliable" hand-picked committees kept on playing down the possible effects of the French nuclear tests in the Pacific. The new Government was obliged to seek the advice of an impartial Academy of Sciences Committee³⁶ to produce a report with which to confront the French. The earlier



Hamilton Industrial Area. "...it is not surprising that urban problems remain high on the list of environmental priorities"

reports were doubtless a serious embarrassment to Australian negotiators in Paris, and they will no doubt continue to be exploited by the French in future argument. As well as softening up the general public, secret collaboration with the French was initiated in the field of uranium enrichment. Fortunately, the cat got out of the bag just at a time when public feeling was running high against nuclear testing. At this stage it became politically impossible to establish a French financed enrichment plant in Australia. Furthermore, the gas diffusion process³⁷ the French were peddling fell into disfavour on economic grounds.

The battle is by no means over, as the Japanese are also interested in unloading an enrichment plant in Australia. Not content with Australia being a quarry, one US Congressman even suggested that American nuclear wastes might be dumped there.³⁸ Indeed, because of politicians and business leaders with their keen eye for short-term profit and long-term ecological myopia, Australia may well become the happy dumping ground for noxious industries and other activities considered ecologically unacceptable by other more ecoconscious lands.

Meanwhile solar energy is languishing for want of funds. Attractive proposals, such as that based on hydrogen generated by solar energy³¹ have fallen on deaf ears, and are collecting dust.

Population policy

The question of an optimal population for Australia is a very controversial one. The vast empty spaces are deceptive, even to most Australians, who have never been to the harsh dry parts of the continent. The country would unquestionably support more people, but under what conditions? Not everybody relishes the idea of the sort of world Colin Clark³⁹ envisages.

Australia's population growth of 2 per cent has been as bad as that of many a country of the under-developed world. Almost half of it has been due to migration.¹ Migrants have played an important part in the history of the continent, but there is no doubt that migration will have to be curtailed, despite the protestations of industry, who continually clamour for more workers. Ideally, they would like a larger local market and a sizable pool of unemployed, so as to break the power of the unions, which have traditionally battled hard to improve the lot of the Unions, which have traditionally of increased migration quotas deliberately forget that migrants are consumers, as well as producers. Consequently it is a bit hard to follow the argument which says that a greater migrant intake would eliminate some of the shortages at present being experienced. It would be just as reasonable to suppose that the shortages were created by

the influx of migrants.

There are moves afoot to do something about the natural increase too. Family planning is making a belated entry on the social scene⁴⁰ for the first time, with active encouragement from the new Federal Health Minister. True, there is much opposition still, largely because of the Catholic element (much of it conservative), which accounts for almost 25 per cent of the population.¹ As there is evidence that Catholics elsewhere are changing their attitude to birth control, a more liberal outlook can be confidently expected before too long. Whether the mere fact of conducting a Population Inquiry will in itself affect the population structure between now and the year 2000 is open to some doubt.

The conservation movement

Most conservationists are still regarded as some sort of cranks by the rest of society. However, the Federal Government is now giving some token recognition to the movement. A sum of £33,000 has been allocated to environmental centres,¹² which are either already operative, or about to open in each State capital and in two provincial centres in Queensland. The offices will provide a common meeting ground for all conservation groups operating within a region. There will be typing, copying and library facilities provided by part salaried and part voluntary workers. The centres will also have telephones, and they will generally be available to any member of the public or any conservation body requiring advice or information.

In addition, bodies needing services of experts for specific local projects will be able to apply for funds from Canberra. This will enable conservationists to fight their battles in a professional rather than amateur fashion.

While specialisation is most desirable, there is still much that is parochial about the approach of individual conservation bodies. As such bodies find common cause with kindred organisations, so affiliations are formed. Each state has its own peculiar environmental problems and its own particular

Government to contend with. It is not surprising therefore that amalgamation has proceeded on a State basis in the first instance.

The Australian Conservation Foundation, may be shaping up to a truly national body, although until recently it was too pro-establishment and out of touch with the rest of the movement. However following a carefully planned "revolution", activists took over after the elections late in 1973. It is interesting to note that Prince Philip now heads a body which many would describe as radical.

As a result of the Conservation Foundation's transformation, the conservation movement has become a much more effective lobby. The first Australian Minister of Conservation (he also supposedly "held" the portfolio dealing with the aborigines and the Arts) was a mere figurehead, with little understanding of what conservation was all about. However, the present incumbent, Dr. Moss Cass is much more sympathetic, even if he does tend to be outvoted in the Cabinet room. A more powerful and united conservation movement can only strengthen the Minister's hand.

Environmental impact statements are still in their infancy and it is therefore uncertain whether the Australian experience will be any better than its American counterpart.⁴¹ Conservationists are realistic enough to know that they won't have it easy for the rest of the 70's but they will be a force no politician will be able to ignore completely.

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HOLIDAYS FOR THE NATURALIST

compiled by Katie Thear

To the purist environmentalist there would presumably be no such thing as a holiday, as any movement from one area to another inevitably has an effect on habitats which he encounters. So he, if he exists, never sets foot over his doorstep. Between this extreme and the equally gross mass-package holiday syndrome, with its damaging effects on indigenous populations, there must be a middle way. Listed below (in alphabetical order) are some organisations and individuals who cater for those of us who wish to enjoy a holiday where the emphasis is on being with nature not working against it.

Barn Owl Travel Ltd., 27, Seaview Road, Gillingham, Kent ME7 4NL. Derek Tutt, a keen ornithologist and conservationist arranges week and week-end bird-watching courses. Most of them are in Kent with its wide variety of habitats, but some are also undertaken in Wales, East Anglia and Spain. The aim is that everyone should receive help and guidance and for this reason numbers on any one holiday are strictly controlled.

Blaenau Riding Tours, Blaenau Farm, Llanddeusant, Llangadog, Dyfed. Tel: Gwynfe 277. These tours are run from a hill sheep farm in the widest part of the Brecon Beacons National Park where buzzards are plentiful and the woods are

a refuge for badgers and polecats. Instruction is given in the handling of ponies and special party rates are available for groups.

Cowley Wood Conservation Centre, Parracombe, North Devon. Tel: Parracombe 200. The Centre has 77 acres of woodland nature reserve nature trails and hides offering excellent facilities for the naturalist. Courses on various aspects of organic husbandry are also held, and all the food provided is organically produced.

Curtis Holidays, 27, Dalmore Road, London SE21. Tel: 01 670 3291. An unusual holiday can be had in the Sierra Nevada mountains of Southern Spain where you stay in a modernised village house from which one of the richest botanical areas of the world can be explored, or irrigation systems dating from the Moors examined. This can be arranged as a villa holiday with car hire.

Cwmllechredd Fawr Farmhouse Hotel, Llanbister, Llanrindod Wells, Powys LD1 6UH. Cwmllechredd Fawr offers the peaceful atmosphere of a prosperous 19th century Welsh farmhouse, and food in the all-Welsh recipes is either home or locally produced. In an area where man's impact on the environment has been slight, rare species of wild flowers and

birds are still to be seen.

Foxton Boat Services, Bottom Lock, Market Harborough, Leics. Tel: Kibworth 2285. With Foxton Boat Services a leisurely and peaceful holiday is possible, cruising through unspoilt countryside on the inland waterways. There is ample opportunity to observe and photograph wild flora and fauna, away from the hectic noise and bustle of city life.

Grange Pony Trekking, Capel-y-Ffin, Abergavenny, Gwent. Tel: Crucorney 215. Situated in the heart of the Black Mountains where wild life abounds and about 90 species of birds are to be seen, Grange Pony Trekking offers a holiday suitable for inexperienced or efficient riders from 10 to 50 years of age. Individual food requirements (vegetarians, diabetics) are catered for.

Heritage Travel, 22 Hans Place, London SW1. Tel: 01 584 5201. Heritage Travel offers a programme of bird-watching holidays abroad. The expeditions are planned in association with the British Trust for Ornithology and each party is accompanied by an experienced ornithologist selected by the Trust.

Highland Guides Information, Aviemore, Inverness-shire. The Cairngorm area, with the largest and least-changed habitats, is possibly Britain's best example of where

THE NURTONS FIELD CENTRE is beautifully situated on the wooded slopes of the Wye Valley.

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Details from Adrian and Elsa Wood, The Nurtons Field Centre, Tintern, Gwent, NP6 7NX.

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s.a.e. for brochure and terms - Dai & Mary Griffiths, Grange Trekking, Capel-y-ffin, Abergavenny, Gwent.

UNIQUE HOLIDAY, ALPUJARRAS SIERRA NEVADA, Southern Spain. Converted Moorish house in village 5,000 feet. Sleeps 5/6. Mod. cons. April-October inclusive. £25-£35 per week. Superb mountains, rich botanical area, bird life, orioles, bee eaters, melodious warblers, eagles. Ring Curtis, 01-670 3291.

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man has tended to live with his natural environment. Highland Guides offer a variety of outdoor pursuits for groups and the individual, and each guide in addition to a good basic knowledge of ecology has a specialist subject — ornithology, geology, hillcraft, etc.

Hotel Boats, Inland Cruising Co. Ltd., The Boatyard, Braunston, Daventry, Northants. Tel: Rugby 890325. Hotel Boats are operated by the owners Peter and Joyce Fox who offer a high standard of personal attention during the voyage through unspoilt countryside. All food is freshly prepared, and they have been experimenting with wild plants for food, not to mention jam and wild fruit bottling en route.

Isles of Scilly Wildlife Holidays, Pednbrose, St. Mary's, Isle of Scilly. Tel: Scillonian 740. David Hunt, a local naturalist has designed his holidays to cater for a wide range of interests in natural history in the beautiful Isles of Scilly. Prices vary according to accommodation requirements, and as places are limited, early booking is essential.

The Nurtons Field Centre, Medhope Grove, Tintern, Gwent NP6 7NX. Tel: Tintern

253. Adrian and Elsa Wood offer a range of informal courses — wild flowers, butterflies, geology, fungi, ornithology, etc. — each with a conservation theme. They stress that all are welcome on these courses, especially beginners. The food reform catering is vegetarian and all produce is organically grown. At the field centre they hope that besides enjoying the exploration and understanding of the world around us we will all come to appreciate our most valuable resource — our land; both as a source of health-giving food and recreation for mind and body. **Starlings Castle, Bronygarth, Nr. Oswestry.** Tel: 0691 72464. Starlings Castle is an ideal base for walkers wishing to explore the Welsh hills with its abundance of wildlife. There is an atmosphere of absolute peace in this area and mountain birds are to be observed without disturbance. Mrs. Llewelyn puts special emphasis on the personal attention and good quality food which is provided at Starlings Castle. **Twickenham Travel Ltd., 22 Church St., Twickenham TW1 3NW.** Tel: 01 892 7606. If you are planning an expedition to obscure places with friends or colleagues it is essential to have a reliable agent who

offers personal and specialised service. Hedda Lyons of Twickenham Travel is just this sort of agent — taking pleasure in co-ordinating travel plans and achieving economical results, and at the same time taking care to protect the environment. Mrs. Lyons specialises in Galapagos and South America but always welcomes novel tasks.

Waterway Educational Holidays, 115 Hillbury Road, Warlingham, Surrey. Waterway Educational Holidays is a partnership of two canal enthusiasts offering a Mobile Field Study Centre in the shape of 'Romulus' a 72 foot long traditional barge. Groups of up to 12 can be accommodated and the waterway journey offers endless scope for studies of flora and fauna, regional geology, etc. **Youth Hostel Association, Trevalyan Hse., St. Albans, Herts. AL1 2DY.** Tel: St. Albans 55215. The Y.H.A. is a non-profit making organisation which offers a wide range of economical holidays including walking, climbing, pony trekking, for those over 16 years, and walking, cycling and bird-watching for the 11–15 age group.

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IS SCIENCE

by Edward

We live in an Age of Faith, not in God but in Science. If most of us are still capable of facing the mounting problems of the world today with relative equanimity, this is because we believe that Science will provide us with the means of solving them: half a millenium ago we would have expected God to do so.

Scientists are functionally the priests of our industrial society. It is only they who are capable of mobilising, for our purposes, the limitless powers of Science, of acting thereby as the intermediaries in our relationship with this new and formidable deity.

It is not surprising that their writings are imbued with an aura of sanctity previously reserved for the holy texts of the established religions. If a proposition is classified as "scientific", then it must be true, indeed incontestable. If, on the other hand, something is branded as "unscientific" then it must be the work of a charlatan. This has provided the Scientific Establishment with the power to prevent any undesired deviation from scientific orthodoxy. In the same way, the Catholic Establishment of the Middle Ages would excommunicate a heretic whose teachings constituted a challenge to their authority.

Indeed, one finds among the annals of the Scientific World some which are strangely reminiscent of mediaeval witch-hunts. Consider, for instance the response of the Scientific Establishment to the publication of *Limits to Growth*. It was branded as unscientific by both *Nature* and *Science*, the world's two most prestigious scientific journals.

In Britain the inquisition was led by Lord Zuckerman, once chief Scientist to the British Government. It is easy to see how he exploited the terms "scientific" and "unscientific" to discredit this very important work in the following outbursts in a speech delivered in Stockholm during the 1972 United Nations Conference on the Human Environment:

"Our newspapers" he proclaimed "urged on by a plethora of *pseudo-scientific* books, articles and speeches are filled with items which warn us that irreversible damage is being done to our physical environment . . . I have referred to a book *Limits to Growth* which has been hailed . . . mainly by the *scientifically* uninitiated as a *scientific* statement about man's environmental problems . . . for my part I have no hesitation in saying that I am among those professional students of environmental problems who dismiss the book as *unscientific* nonsense".¹

What Is Science?

In view of this, it is clearly important that one should know just what "Science" is, and precisely how one determines what constitutes a "scientific" proposition.

"Science" does not appear to have ever been adequately defined.

In general, it seems to involve the accumulation of knowledge. But what is knowledge? Here we encounter a major snag:— To answer this question we must leave what is generally regarded as the realm of "exact science", and enter that of Epistemology or the Theory of Knowledge.

For scientists to regard Epistemology as being outside the scope of Science is to renounce the responsibility for examining the assumptions on which their work is based, for determining in fact, to what extent it is justified.

This task is delegated to people who, working outside the field of Science, know very little about it, and who like most specialists today, tend to regard their field of study as largely autonomous, as something that can be studied in isolation from everything else. As a result one finds little in current epistemological writings which can serve to provide a theoretical basis for Modern Science — a lamentable situation. As Einstein wrote "Epistemology without contact with science becomes an empty scheme. Science without epistemology — in so far as it is thinkable at all — primitive and muddled."

What is Knowledge?

Knowledge is clearly some sort of information. To qualify as knowledge, however, this information must display certain characteristics. According to Ayer, who appears to be one of the principal spokesmen for the modern school of Empiricism, it must be true, we must know it to be true, and for the right reasons. This implies, above all, that knowledge is conscious infor-

A RELIGION?



Goldsmith

mation of some sort. This is presumably the only type of information which can be studied empirically. Also, it is by basing one's behaviour exclusively on such information that one is regarded as acting "rationally".

If epistemologists knew a little about such subjects as Cybernetics, Ethology and Psychology, they would realise that conscious information plays by no means a determining role in the behaviour of even the most sophisticated members of the species "Homo Rapiens". To understand the use of conscious information without reference to that of unconscious information is simply not possible. In fact to understand the use of information in the brain is difficult without examining it as part of a general theory of information, which must mean examining the way it is built up and made use of by systems at all levels of organisation. Such a study would reveal that information in the brain is built up and used in very much the same way as it is in a gene-pool or a fertilized egg and that there is only one way of organising and using information among natural systems.

Control

The reason for this is that information is only built up *for one purpose*, and that is *to constitute a model of the relationship of the system of which it is part with its particular environment*. Information is, in fact, of no value by itself as a basis for behaviour. To identify a technological device as being a nuclear power station, for instance is of no value if one has not previously built up a model of the relationship between a nuclear-

power station, the biosphere of which we are part and the rest of the technosphere of which it is part. Only in this way can one understand what are its implications and hence how we should react towards these diabolical contrivances. It is a serious illusion to suppose that the mere fact of attaching a label to something provides information about it.

If information is only built up for a single purpose, this is also true of the model of which it is part. A model is only built up for the purpose of serving as a basis for the control of a system's behaviour towards its environment.

This whole notion of control is largely ignored by epistemologists as well as many scientists who have implicitly adopted the empiricist position. There is a good reason for this. If a system is controlled, it must mean that it is goal-directed or purposive, for what else can control mean but to keep something on its correct course? And how can it be kept on its correct course if it doesn't have one? The goal, needless to say cannot be pin-pointed in space-time. It is simply that course along which discontinuities and their corrections are reduced to a minimum. By taking such a course a system is capable of maintaining its basic structure in the face of environmental challenges, i.e., *of remaining stable*.

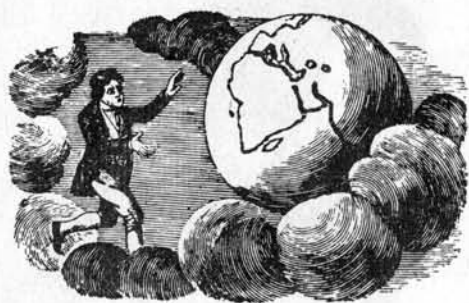
It is also by taking such a course that free energy is reduced to a minimum *over a long period*. In this way the system remains in four-dimensional equilibrium with its environment. This principle of directiveness is irreconcilable with empiricist philosophy, since it cannot be induced on the basis of

observation, i.e., according to what empiricists regard as the only legitimate way of building up knowledge. Also, it justifies a methodology for building up knowledge which is in competition with induction. I refer to deduction from the general principle cited. Thus one could postulate that to maintain its stability in specific environmental conditions a system must be able to achieve a given set of sub-goals. A specific behavioural act could therefore be explained in terms of its contribution to the achievement of a sub-goal, and judged in accordance with its ability to do so. This is in fact the cybernetic as opposed to the reductionist approach.

To reject the directivity principle, however, is to reject the very principle of organising information, and hence, among other things, the possibility of Science. The reason for this is very simple. Information is built up out of data, the raw materials of information. Data, as we shall see are interpreted in the light of a system's model of its relationship with its environment, and then constitutes information. This means putting "mental order", I suppose one might call it, into what might previously have appeared to be random data. This is only adaptive if this order corresponds to something, i.e., if it reflects an ordered situation. Since behaviour is, by its very nature, dynamic, i.e., involves change, this change must be orderly *which means that it must be heading in a given direction*.

The Mechanism of Control

Cybernetics has probably contributed more than any other discipline to the unification of Science by demonstrating that control, at



all levels of organisation, is achieved in the same way that, in fact, the basic cybernetic model is of universal application.

Data are obtained, transduced and interpreted. A hypothesis or model is postulated and projected back onto the data, followed by a modified hypothesis and a further projection. Each time the hypothesis is made to fit better with the general model of the system — either by modifying the former or the latter. This can be repeated over and over again, and in this way there will be a continual monitoring of a series of even better hypotheses formulated after successive accretions of information. This process gives rise to a damped system, i.e., one in which errors are progressively reduced. If interpretation is taken as tending towards a position of four-dimensional equilibrium, i.e., along an equilibrium course — which we can represent by a straight line, it will in fact take the form of a series of oscillations of ever-diminishing size — tending towards the reduction of errors, — i.e., the development of an ever better representation of the system. On the other hand, if this mechanism does not function properly, i.e., if the system gets out of control, then the oscillations will increase in size. This of course cannot continue indefinitely, the discontinuities would become increasingly insupportable and the system would eventually collapse — just as is happening to our society today.

At this point it might be worth noting that for two million years or so, human social systems displayed considerable stability. Unstable social systems appear to have been largely confined to recent times, i.e. to the period following the neolithic revolution.² Even during this period, traditional societies which have succeeded in remaining outside the

orbit of mainstream civilisations have continued to display considerable stability. Such stability can only be achieved in one way, and that is by the operation of a control mechanism of the type described above.

This mechanism is provided by its culture, of which an essential component is a specific world-view or model of the society's relationship with its environment, a corresponding goal-structure and a means of achieving it.³

Science appears to be an attempt to replace the cultural information which makes up traditional world-views which is very different in the case of each traditional society with a single organisation of information which should theoretically serve *each of them equally well, It is an attempt, in fact, to substitute objective for subjective information as a basis for control.*

Such a substitution has many implications, which I shall look into in this article. First of all, however,

For two million years or so, human systems displayed considerable stability. Unstable social systems have been largely confined to recent times, i.e. to the period following the neolithic revolution.

let us consider what can conceivably justify it.

Epistemologically, the answer is fairly obvious. Traditional information does not qualify as knowledge. It is only true vis-a-vis a largely subconscious and very subjective model and not vis-a-vis a conscious objective one.

It involves reference to such things as Gods and spirits whose presence is empirically unverifiable, while it establishes a strange set of cause and effect relationships between men's ritual activities, the behaviour of these Gods and spirits

and day to day biological social and ecological events, which can be shown to be "irrational".

Objective truth must be the overriding criterion for judging the validity of information. We all assume that this must be so . . . but why? On what is this assumption based? I shall show in this article that this is epistemologically unjustified, in fact that it is a pure act of faith.

If cultural information is organised subjectively rather than objectively, it provides a society with a very restricted view of its environment, that which it has so far required for its own specific adaptive purposes. If information be organised objectively, it is assumed that it provides a faithful reproduction of the outside world, which should provide the basis for a much wider range of adaptations, enabling a society in possession of this objective information to adapt to all possible eventualities.

For this to be so, a number of obvious conditions must clearly be satisfied:

The first is that objective information *can* be organised to constitute an effective model of Man's relationship with his environment.

The second is that this model can effectively be made use of to control this relationship.

The third is that this would enable Man and his society to adapt to important and improbable changes, i.e., that there are no other limits to their potential for adaptation. I shall show in this article that all these assumptions are false.

Science has not Provided so far a Means of Controlling Society

We are living in an age in which public policy has, for the first time, been largely influenced by Science. In spite of this society is increasingly out of control, hence unstable, and the discontinuities we are subjected to are on an ever increasing scale, so much so that we are well on the way to social and ecological collapse. On strictly empirical grounds one cannot avoid the conclusion that Science has been a failure.

Objective Truth

Objective truth does not appear to be the relevant criterion for judging the value of information used by natural systems. Genetic information is not objective. It is specific to a particular individual as a member of a particular species. Cultural information is not objective either. In fact one can go further and say that as the biosphere has evolved out of the *primaeval* dust, as complexity and variety have built up so has the corresponding subjective information determining this evolutionary development. To substitute a single organisation of objective information for the multitudinous organisations of subjective information, which are at present used to control the behaviour of natural systems, would be to reverse evolutionary trends and hence to foster informational entropy.

It could be objected that objective information also displays order or negentropy. This is true only in the sense that the technosphere displays order. Order is but another word for organisation. Things are organised for a particular purpose to satisfy a particular goal. Random organisation is a contradiction in terms. Now the goal of the technosphere is very different from that of the biosphere. The former is designed to provide Man, one of the myriad forms of life which inhabit this planet, with the maximum comfort and convenience, whereas the latter being concerned with the maintenance of its overall stability is concerned with catering for the requirements of all, not just one of the forms of life which constitute it. They all have an essential function to fulfill within it.

Both organisations of matter are in fact in competition with each other since the former can only maintain itself by extracting resources from the latter and consigning to it its waste products. From the point of view of the biosphere the technosphere constitutes waste or randomness or in fact entropy. Similarly from the point of view of that organisation of subjective information associated with the biosphere, objective information constitutes entropy. It has

played no role in building up the biosphere *on the other hand without it there would be no technosphere.*

Why should this be so?

In the biosphere, a system could adapt either by modifying its environment to satisfy its own requirements or by itself undergoing change to satisfy these requirements of a changed environment. In practice both strategies are resorted to. We have seen that the justification for Science must be to permit rapid and radical adaptation which a traditional culture would not do. When rapid and radical change is required however the former strategy is the only possible one. It is quicker and easier to adapt man to living in a cold climate, for instance, by building him houses with central heating, double glazing, etc. than by bringing about those physical changes in him which would enable him to support the cold weather. Thus in practice

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objective information simply permits environmental change. If this environmental change were not regarded as desirable there would be no reason for replacing traditional subjective information with scientific objective information. Objective information can thereby serve but as a basis for reducing the order of the biosphere of which we are part.

Practical people will not accept so strongly worded a condemnation of the technosphere. They will insist that by clever management it is possible to reconcile the two, to achieve some sort of a compromise

between the rival goals of the biosphere and the technosphere. Besides it will be maintained, human ingenuity, combined with omnipotent Science must be able to compensate for the reduced stability of the biosphere, by devising means of correcting the resultant discontinuities.

The failure of Science could be rectified if our knowledge were improved, if Science were reorganised, if, for instance, it could be unified to provide us with a single model of the biosphere in its inter-relationship with the technosphere.

This too was my feeling twenty years ago. In fact, I spent many years working out a general model of behaviour which led to my book (unpublished) *The Theory of a Unified Science*. Since then, however, my views have changed. This is why.

The Empiricist Thesis

Firstly it would mean abandoning the empiricist thesis which underlies science. According to Empiricist epistemology, knowledge can only be obtained by observation. This thesis is manifestly false. The child's mind at birth is far from being the "*tabula rasa*" which this would imply, for instance, a child is, and must be, in possession of a rudimentary model of its relationship with its environment. This has been shown to be true experimentally. Fantz,⁴ for instance showed that chicks are born with a tendency to pick at certain objects rather than others — but we do not need such experience to prove this point. If a species is to be stable which means if it is to display continuity, i.e., remain stable then its behaviour must be based on *information which itself displays continuity*. Each generation must inherit information which reflects the experience of its ancestors going back into the mists of time. That is why genetic information is so stable. If it were more plastic and could permit adaptations to changes based on the experience of one or two generations only it might give rise to adaptations to what could turn out to be freak conditions unlikely ever to recur — such as the situation created by our industrial society. Its behaviour would display no continuity.



It would be unstable — and hence could not survive.

Building up information means improving the model so that it may serve as a basis for ever more adaptive behaviour. This improvement, contrary to what Empiricists may think, does not simply consist in accumulating more data but also in organising it within the model.

The establishment of a new relationship between two of the variables of a model, for instance, permitting an improved explanation of certain observable data must provide information without involving the simultaneous detection of data — thinking — in other words.

The notion that all information is only built up by observation is thus simply not true. However one can go further than this. What is the status of that information which is built up by observation?

The first feature is its subjectivity. *Detection is a directive process. It does not consist of randomly accumulating data, but rather of isolating from all possible data that minute fraction of it which appears relevant to a system's behaviour pattern.* Thus, as Judson Herrick points out:

"The skin is sensitive to mechanical vibrations up to 1,552 per second, but beyond that point feels only a steady push. The ear is aware of sound travelling by wave lengths of 13mm up to 12,280mm, but does not hear sounds below or above these limits. The skin is aware of heatwaves only from .0008 to .1mm long. The eyes take cognizance of light waves from .0008mm to .0004mm, but miss electric waves, ultra-violet waves, x-rays, gamma-rays and cosmic rays, running from wavelengths of .0004 to .000,000,000,008mm".⁵

This first genetically determined

selection is complemented by a further ontogenetically and largely culturally determined one. *Thus at any given moment we can detect but a minute fraction of those data which we are genetically equipped to detect* — those which may appear relevant to our behaviour in those particular circumstances in which we find ourselves at a given moment.

This leads one to the essential consideration that detection can only occur on the basis of a pre-existing model, more precisely two models — a genetic one and one which might be called a cerebral or cultural one, in terms of which is calculated the relevance of different data to a system's behaviour pattern — yet another reason for rejecting the Empiricist thesis.

Data in fact are detected and interpreted in order to confirm or invalidate the model postulated. One might however ask on what basis is the model postulated? The answer is that which appears most probable

A scientist's interpretation of a situation tends to be that which above all satisfies his personal psychological requirements.

in the light of the model one has built up during the course of one's experience.

A brain, like any other organisation of information made use of by natural systems, acts among other things, as a *probability calculator*.⁶

Contrary to what most people think, scientists proceed in precisely the same way — they select data on the basis of a preconceived model — partly objective, probably partly subjective too, in terms of which the data are subsequently interpreted.

Indeed, scientific theories, rather than being reached "inductively", in accordance with empiricist theories, must be regarded as post-

ulated, as the most probable explanation of certain data on the basis of their specific model of the world about them, in other words, deduced from this model.

In this way, Le Verrier postulated, by purely mathematical means, the then unknown planet Neptune as an explanation of certain otherwise inexplicable disturbances of other planets. Later, "... when the German astronomer Galle directed his telescope to the spot in the night sky that had been figured out by Le Verrier, he saw there a tiny speck that changed its position slightly from night to night, and the planet Neptune was discovered (1846)".⁷

Dirac postulated the positron as the most elegant way of explaining certain atomic phenomena inexplicable in terms of existing variables.

Epicurus and his disciple Lucretius postulated the atom, and Bohr postulated the modern version of this ancient hypothesis. Watson and Crick proceeded in the same manner when developing the genetic code, as is revealed in their book, *The Double Helix*.

These discoveries are well-known. There is a tendency, however, to regard them as scientific curiosities — and as exceptions to the general rule that science develops inductively by the meticulous examination of impartially accumulated data, in accordance with the Empiricist thesis. *I think that on the contrary, they are merely striking examples of what is the only possible method of science.*

Every scientific proposition is in fact a hypothesis. The objective value of this hypothesis depends on that of the model on which it is based. If it were based on a fully integrated general model of the biosphere then it would have considerable value. But such a model is not available. More often than not, for reasons we shall look into later, it is based not only on incomplete information but on incomplete subjective information. A scientist's interpretation of a situation tends to be that which, above all, satisfies his personal psychological requirements. The distinction often made between "scientific facts" and "mere hypotheses" is totally unjustified

epistemologically. If knowledge is acquired by observation (and observation, as I have shown is but an interpretation of data, i.e., a hypothesis) knowledge must consist of hypotheses.

Consider one of Lord Zuckerman's "scientific facts", taken from the same speech at Stockholm. He points to the "increasing physical and intellectual violence to which we are all subjected" and attributes this to the frustration of not being able to increase our standard of living fast enough. He points to the disparity of living standards between and within countries and argues that if this were reduced, violence would cease to be a problem.

This is clearly one of a large number of possible interpretations of the available data, not that which is best reconcilable with available knowledge, but that which best suits his desire to prove that the *Limits to Growth* argument is wrong and that economic growth is necessary.

What is more, this hypothesis will be influenced by all sorts of subjective factors such as what one expects to see, what other people persuade us we should be seeing, etc. *Perception and by the same token the interpretations it gives rise to are purely subjective and bear no relationship whatsoever with the objective measuring rod which Empiricists make them out to be.*⁸

On the contrary, rather than provide objective information on the thing perceived, perception tends to provide instead, objective information on the personality of the perceiver — as is pointed out by Witken who wrote a book to prove this point.

Perception also is functionally the same thing as computer simulation. Simulation is selective since it only deals with data which can be interpreted in such a way that they give rise to a change in the value of one or more of the variables used in the model. The implications of this change are calculated in terms of all the other changes this must bring about to the value of the other variables in terms of which it is interpreted.

There is a big difference between the two processes however, — for

perception is simulation on a purely subjective model and cannot thereby provide a basis for building up objective information or knowledge while computer simulation is supposed to be objective. This is of course the ultimate reason for rejecting Empiricism. The implications however are obvious. What is required is a means of by-passing perception, of replacing it with an objective means of building up information. But is this possible?

A first step is to replace gradually the subjective vocabulary which we have inherited as part of our cultural heritage and in terms of which we persist in describing the world about us. I refer to such words as "mind" "consciousness" and practically all the other terms used by Empiricist philosophers, not to mention sociologists.

This has been happening for some time. Indeed, with the development of knowledge, man's view of the world becomes couched in ever less

more relation to the 'visualizable' or 'intuitable': optics and electricity fuse into electro-magnetic theory; mechanics and the theory of heat into statistical thermodynamics, etc."¹⁰

Thus as science advances, the variables used are further and further divorced from those of our experience. As one would expect, it is in modern physics, the most advanced of all disciplines, that this tendency is most accentuated. Thus the physicist's concept of "time" as dependent on velocity and as inseparable from space, the pi-meson with its lifespan of two millionth of a second; the electron that weighs only a billionth of a billionth of a gram; and anti-particles that may run counter to time and that may originate in the future and become extinct in the past — all of these are obviously totally outside the world of our experience.

Compartmentalisation

Another great barrier to the unification of Science is the practice of dividing up knowledge into separate disciplines each dealing with a set of things that *appear to have something in common*. This is a direct consequence of the adoption of Empiricism.

The biosphere is a single integrated system made up of closely integrated and hierarchically organised sub-systems and sub-sub-systems. It is dynamic, not static, and is therefore the product of a single integrated process. Quite clearly it cannot be understood in terms of these separate disciplines.

Indeed changes occurring within a specific field must inevitably cause changes in other fields about which a specialist would have very little knowledge. In addition changes in other fields would also cause changes in his field which he would have no means of understanding. As a result specialists are not only incapable of interpreting and predicting changes occurring outside their particular field of study but also, and this is possibly even worse, within it.

This means that the changes condoned and even proposed by specialists and in particular that brand

Modern Science is an accumulation of half truths — and it is on the basis of these half-truths that we are trying to control the world, and as a result bringing about its annihilation.

subjective terms, i.e., terms which are ever less those of our own personal experience. As Konrad Lorenz says, "Every step of knowledge in physics means 'taking off a pair of glasses'."⁹

Von Bertalanffy writes: "It is an essential characteristic of science that it progressively de-anthropomorphizes, that it progressively eliminates those traits which are due to specifically human experiences. Physics necessarily starts with the sensory experience of the eye, the ear, the thermal sense, etc., and thus builds up fields like optics, acoustics, the theory of heat, which correspond to the realms of sensory experience.

"Soon, however, these fields fuse into such that do not have any



referred to as experts, are based on what may occasionally be objective information, but are necessarily only *part of the relevant objective information*, and this, as already shown, cannot serve as the basis of action. Their arguments may be true but they must of necessity present *only part of the truth*. *Modern Science is in fact at present but an accumulation of half-truths — and it is on the basis of these half-truths that we are trying to control the world, and as a result bringing about its annihilation.*

Can we get round this? As we shall see to design a unified Science or general behaviour model is relatively simple. I could provide you with the basis of it right now. But it would never be accepted let alone made use of. One reason is that it would require multi-disciplinary cooperation.

Unfortunately, specialists in the different disciplines have developed different terminologies and methodologies and contact between them is almost impossible save on a superficial basis. This situation is getting worse rather than better. Prestige is acquired by becoming more technical and more esoteric rather than less so. What we are in fact witnessing is the operation of a basic psychological tendency — towards territoriality. Non-specialists must be kept out of one's territory, and ambitious men go so far as to carve out their own academic territory on the slightest pretext. Look at Cybernetics. Here at last was a tool which could be used for unifying the sciences. It was not to be. Not only has it become increasingly technical, but its domain has already been sliced up by ambitious academics. Von Bertalanffy called his territory General Systems, Forrester Systems Dynamics, and I am sure there will be lots more. In this way, instead of merging the various

disciplines it has actually given rise to at least three new ones.

Why we can predict the failure of multi-disciplinary research, with total confidence, however, is that the different disciplines having evolved in vacuo, *are not compatible with each other.*

Modern Economics is incompatible with both Anthropology and Ecology. Modern Medicine is irreconcilable with Evolutionary Theory. Modern Dentistry with its dependence on X-Rays with Radiobiology etc.

For effective multi-disciplinary work to occur, specialists would have to admit that many of the principles on which their disciplines are based are in fact false. Can we expect them to do so? Can we really expect people who have established a reputation in a particular field after years of hard work to admit that their work is based on faulty assumptions and has thereby been in vain? Of course not. They can be counted upon to rationalise any extraneous information which appears to menace their professional status in such a way that it will cease to do so. This is precisely how the experts have reacted to *Limits to Growth*¹² and our own *Blueprint for Survival*.¹³ The mental acrobatics they are willing to resort to in order to rationalise their own world-view in the face of massive evidence which renders it objectively untenable is truly astonishing, and in a way rather pathetic. The effect of this natural psychological tendency however is to render multi-disciplinary research largely impracticable.

Atomisation

The Empiricist thesis also leads to atomisation, i.e., to the breaking down of things into their constituent parts for the purpose of studying them in controlled laboratory conditions.

I am not suggesting that this is not useful, only that it is not sufficient. This provides information on the constituent sub-systems, but it provides no information on the role played by the system in the larger systems of which it is a part. Often this is not even conceivable since we are dealing with systems

of a large and diffuse nature such as human societies and eco-systems which simply cannot be examined in controlled laboratory conditions. By looking at the parts however one can get very little idea of the whole.

What is particularly significant is that many scientists ignore the very existence of such systems. Indeed, the very concept of an eco-system is probably less than 30 years old.

If a set of systems are part of a larger one it means that they are subjected to a particular set of constraints which will enable them to act for certain purposes at least as a unit. Order is in fact defined as the influence of the whole over the parts. The fact that we have not recognised that we are part of a larger unit called an eco-system means that we are totally unaware of a whole set of constraints which we must observe if we are not to destroy the larger system of which we are but the differentiated parts. Even more astonishing of course is the fact that the importance of the social system is not generally understood by the scientific community. It is generally considered that any group of heterogeneous people can constitute a society so long as they occupy the same area. The notion that a society is a behavioural unit in its own right, a natural system in the sense that a biological organism is a natural system, is accepted by but a small minority of thinking people with a knowledge of the functioning of the tribal societies in which man has been organised during 99 per cent of his tenancy of this planet. Yet this is unquestionably so, and the fact that it has not been accepted means that we have ignored yet another set of extraordinarily important constraints to which our behaviour is normally subjected.

To understand the behaviour of man without reference to the larger system of which he is part, is like trying to understand the behaviour of a cell without reference to the organ or tissue and the biological organism to which it belongs. It is, in fact, quite obviously impossible.

Thus, the ills that industrialised society is suffering from such as crime, delinquency, alcoholism,

To understand the behaviour of man without reference to the larger system of which he is part, is like trying to understand the behaviour of a cell without reference to the biological organism to which it belongs.

drugs, etc., cannot conceivably be understood by our scientists—unless it be first postulated that society is a natural system which provides its members with the requisite social environment. Only then can these ills be correctly interpreted as the pathological manifestation of social disintegration, and from the point of view of the victims, as the symptoms of social deprivation. Instead these ills will continue to be interpreted as the signs of material deprivation:—a convenient diagnosis in a society geared to the production of material goods, but one which, by causing further industrialisation must lead to further social disintegration and correspondingly aggravate the ills which this must give rise to.

Continuity

In addition, one cannot understand the working of a system by examining it *without reference to its past*. For a system is not autonomous. It has inherited a model of its relationship with its environment which provides it with a goal-structure and a set of instructions on how to achieve these goals.

As I have already stated, this model reflects the system's experience over a very long period. In this sense a system exists in time as well as in space. That which is visible to us, and which is actually there, is but a part of it, a very small one at that, and to understand its functioning it should be best regarded as only a link in a spatio-temporal continuum. This is in fact the case of a traditional human society. A tribe is made up of the living, the dead and the yet to be born. Only in this way can it display continuity or stability. When a society disintegrates, *it does so in time as well as in space*. Living in

the cultural void created by industrialisation we are not only alienated from our fellow men, but also from our ancestors and increasingly from our children. *In fact, we are temporal as well as spatial, isolates*. What is more, the information which a system has inherited from its past can give rise to a very large number of possible systems *of which it constitutes but one possibility*. Each cell for instance starts off with the full complement of hereditary information which would enable it to form part of any specialised issue within the organism of which it is part. Slowly it learns to fulfil a particular function, and thereby comes to make use of a specialised part—constituting but a minute fraction of available information. The same occurs at other levels of organisation. A population, for instance, makes use of but a minute fraction of the information contained in the gene-pool. No system can be understood however, unless one takes into consideration all the alternative systems which the information its development was based on, could have given rise to.

The unification of Science must involve building a model of the behaviour of that all-encompassing system which is the biosphere, and as we have seen, atomisation, a methodology indisassociably linked with Empiricism cannot enable one to understand the behaviour of such a system.

Measurement

It can be argued that any “deficiency” in perception can be made up for by measurement. Measurement in fact has become a veritable fixation among scientists today, so much so that it is seriously held that propositions which cannot be measured, cannot thereby fall within the scope of science. Unfortunately, a number of important variables cannot be measured. How does one measure the information in the cultural pattern of a traditional society? How does one measure the bonds which hold together the different members of a family and which are extended to hold together the human community?

If only a fraction of the factors

which would have to be taken into account in a general model of behaviour, are measurable, and can thereby be made use of for the formulation of scientific propositions this is tantamount to admitting that scientific behaviour must, by necessity, be based on *partial information only*—and cannot thereby serve as a basis for adaptive responses.

This is particularly true of the *Limits to Growth* model of Man's present predicament. One of the main criticisms levelled at this stage was that the values given to the variables were not based on sufficient evidence.

The basic argument of *Limits to Growth* however is not affected by the discovery that the world's resources of copper, bauxite or manganese are higher than Meadows thought, nor for that matter that the environment can absorb more of the waste products of industrial processes than he and his colleagues had estimated. The model simply reveals that our society is heading in the wrong direction. The further it continues in this direction the greater will be our commitment to the use of resources which will be in increasingly short supply, and the greater the amount of waste which it will have to consign to an environment with an increasingly limited capacity to absorb it. The lesson to be drawn from this study is that we must cease moving in this direction, in fact that we must move in a totally opposite one.

Interpretation of Measurements

There is no point in measuring things unless one knows what their value should be. Yet one cannot know the ideal value of any variable in a model representing a given system, unless one knows what are the values of the other variables and what are the relationships between them. *An individual measurement is simply of no value*.

What is important is to determine the principles underlying the functioning of a natural system, to establish what are the relevant variables and how they are related. What the actual values should be is the function of so many petty technical factors, that it is not in



Health Organisation, according to Laird, receives between two and three thousand new ones each year for examination. WHO does not have any research facilities of its own so that these products must be farmed out to be examined by independent laboratories. For both financial and administrative reasons less than ten per cent of them are examined in this way. What makes the problem particularly intractable is the synergy which often obtains between different combinations of pollutants.

Scientists are constantly discovering new synergic effects. For instance, it was found that the combination of Benzyphenone with carbon dioxide can produce lung cancer in experimental animals. Also animals infected with flu virus can contract lung cancer if at the same time they have been exposed to artificial smog.

DDT is regarded as presenting little hazard to marine life by virtue of the fact that it is only very slightly soluble in water. However, it appears to be something like ten thousand times more soluble in oil, which means that the combination of DDT and oil can prove lethal to many forms of sea life.¹⁵

Very disturbing is the synergy between asbestos and cigarette smoke. It has been estimated that asbestos workers who smoke have a 92 times greater risk of dying of lung cancer than men who neither work with asbestos nor smoke.¹⁶

In addition, it is logistically impractical to examine the long-term effect of sub-lethal doses of the different pollutants. Yet these are often as important if not more so than the more spectacular effects of large and sudden doses. For instance, a few parts per million of DDT in water can upset the temperature regulating mechanism of young salmon.¹⁷

Sub-lethal amounts of DDT can be lethal when associated with falling temperature and starvation. This apparently explains why in a river in New Brunswick in 1969 there was considerable mortality among salmon during the cold weather that followed an earlier fish kill attributed to high levels of DDT.¹⁸

Sub-lethal dosage of different

pollutants can also have subtle effects on all sorts of behavioural mechanisms, on the ability of fish for instance to find their way about, or to detect the presence of other fish. Vorster considers "that the subtle effects of CHS on avian reproduction have a greater overall impact on bird populations than an acute dose on more indirect mortality, even though a bird kill may seem more spectacular."¹⁹

Another problem is that of sampling. There is no guarantee that the levels measured during a given period are in fact representative. Thus analyses of Rhine water have so far identified some 200 different pollutants and these are regarded as constituting perhaps no more than one-tenth of those present. Dr. Sontheimer, a chemist involved in this work, has said they have no way of foreseeing "what will be floating in the river tomorrow . . . A cleaning process that works one day, works badly the next day."²⁰ Moreover, even were it possible to devise the correct monitoring equipment and purification plant the cost would be prohibitive. Sontheimer considers that it would cost at least 10 times more to extract poisons already diluted in the Rhine than it would to keep them out.

The argument against measurement is very much that against atomisation.

To understand how the world works one must look at the whole, not the parts, and proceed by deduction rather than induction.

Our understanding of pollution, for instance, will not be built by examining and measuring levels of individual pollution, but by examining the principle involved in the light of a general behavioural model of unified Science.

Centralisation of Information

A further insurmountable problem is that arising from the centralisation of information. Indeed, the replacement of subjective information by objective information involves centralisation and this has many implications.

Consider the island of New Guinea where there are at present 700 different tribal groups, each with

measurements which conflict with cherished subjective beliefs, tend to be interpreted or rationalised in such a way that they cease to do so. Defenders of industrialisation still maintain for instance that the cancer rate is not increasing in industrial society. What has increased, they maintain, is *our ability to diagnose it*. This myth is only being exploded as we are beginning to know more about the health of tribal societies.

In the same way Zuckermann refuses to admit that lead poisoning is becoming an increasing menace. He writes: "The risk of being poisoned today is probably as small as at any time since lead started to be mined. *But we have now developed the ability to detect the presence of this element*. And of others, like mercury in very small concentrations."¹⁴ Measurements, in fact, are but precise means of detection. As such, they provide data, not information. This is obtained by interpreting them in *the light of a largely subjective model*.

Logistics

In addition the measurement of the parts of a system in isolation from each other is a vain task, for purely logistical reasons. The number of interrelationships between them simply defies calculation. Let us consider the problem of pollution. Is it in fact possible to examine in laboratory conditions the precise effect of introducing a new chemical substance into our environment? The answer is no. Man has already put over half a million pollutants into the environment and there are several thousand new ones every year. The World

its own religio-culture. If the country were modernised these would inevitably be destroyed as the population was herded into large industrial complexes in which the children would soon be subjected to the standard western-type education.

These religio-cultures have developed over the course of thousands of years, not at random, but for a specific purpose — that of enabling the tribal groups in question to achieve a stable relationship with their environment. This they achieve remarkably well, as can be attested by all those who have examined the behaviour of tribal societies. However it is considered by us that their behaviour would be more adaptive were it based on a single organisation of information — the one which reflected objectively the world they, as well as countless other social groups throughout the world, happen to live in.

We forget, however that a society is a natural system, and it can be shown that its religio-culture is an integral part of it, that part which ensures its control. If one removes an integral part of a social control system in this way why not do the same with other systems? Why not for instance centralise genetic information? Why not start a world genetic data bank, which animals wishing to reproduce themselves in a modern and scientific way, whether they be fiddler crabs, dung beetles, or human beings, need but contact so as to obtain, by the aid of some giant computer, all the genetic information that they may require for this purpose? However ridiculous this suggestion may sound, in behavioural terms the same principle is involved. In both cases it means counteracting the processes leading to the evolutionary development of normal control mechanisms. Such action is anti-revolutionary and can only lead to an increase in randomness. Let us push the argument still further. If we deprive the inhabitants of New Guinea of their social control mechanisms, in the interests of centralisation, why don't we do the same for the other mechanisms involved in their life processes? Why do we not set up, for their benefit, a single computerised liver for

action is anti-evolutionary and can instance, or a complete digestive system which would deal with all the digestive processes of the island's population thereby freeing it of digestive worries and letting it concentrate on more progressive activities such as watching T.V. or going to football matches? Once more the example may appear absurd. But in cybernetic terms it is not absurd at all. Natural systems must be self-regulating if they are to be stable. A control mechanism is an integral part of a system. Remove it and the latter disintegrates, just as would an organism if one were to remove its liver or its digestive system. That is why traditional societies have not survived the destruction of their religio-cultures.

Differentiation

The original instructions initiating a behavioural process are differentiated during their implementation so as to adapt them to environmental requirements.

In this way the process cannot be explained solely on the basis of these instructions. Nor does the model on the basis of which the instructions are justified, suffice to justify the totality of instructions given at each level of organisation as behaviour proceeds. This principle is well illustrated by the behaviour of an army.

It is not even remotely conceivable for a General to issue a complete and detailed Plan of Action, which will be observed to the letter at every echelon down to that of the

Natural systems must be self regulating if they are to be stable. A control mechanism is an integral part of a system. Remove it and the latter disintegrates.

section. The General cannot tell the exact nature of each problem that will be encountered by his men during the implementation of his instructions. He cannot know the position of each boulder, each tree, each bush which the individual soldiers will encounter — the physical strength of each individual opponent, the ruses he will resort to. In other words the imposition of a

complete Blueprint from above is totally unadaptive. These instructions must be subjected to changes accommodating environmental influences, in precisely the same way as the cultural information on which is based a traditional cultural pattern is subject to evolutionary change.

In the case of an objective pattern of information, the mechanism for ensuring its differentiation is absent.

Consider that most of the disciplines into which knowledge is at present divided are based on a very insufficient sample of the total human experience. Modern economics, for instance, is based on the Western experience during the industrial age.²¹ It is assumed indiscriminately to apply to traditional societies, and efforts to apply it in this way have led to social disruption on a considerable scale.

Modern agriculture has been devised largely on the basis of the experience of European countries enjoying a temperate climate. Its indiscriminate application to tropical areas has led to wholesale soil destruction and desertification.

Ideas of government are just as sociocentric and their exportation to Africa and Asia has led to the erosion of traditional cultures and to the setting up in their place of unstable political regimes which are nothing more than parodies of their already largely unsuccessful European counterparts.

All this is largely the result of the failure to adapt centralised objective knowledge to local requirements — to differentiate it, in fact, as subjective information is differentiated during the behavioural process among self-regulating natural systems.

The Non-plasticity of Generalities

The reason why the mechanism for adapting apparently objective generalities to environmental requirements is absent is that we cannot avoid regarding them subjectively as *a priori* truths, and thereby to rationalise any experiments which would invalidate the principle of their applicability. Why should this be so? The reason is simple, the model used by the control mechanism of a natural system



regardless of its level of complexity constitutes a hierarchical organisation of information. Information is organised in it in accordance with its degree of generality. The more general the information, the more important it is, since it colours all the other information in terms of which it is differentiated. Also, the more general it is, the longer the experience of the species or of the social group (in the case of cultural information), which it reflects. The more, therefore, it can be predicted that the circumstances to which it mediates adaptive behaviour are likely to be present, the less modifiable is this information.

Traditional man could predict with confidence that the circumstances that have been present for thousands of years are likely to continue being present. Their whole cultural pattern depends therefore on the continued presence of these circumstances, and little or no provision is made for their possible absence. Thus, the cultural pattern of a fishing society living on the edge of a lake would assume that the lake does not go dry and that its fish population is not depleted. An Eskimo society living in the Arctic wastes will assume the particular climatic conditions in which it lives. Neither the fishing society, nor the Eskimo society can cater culturally for *drastic changes* in their basic relationship with their environment. If such changes occur, then the cultural patterns in question will collapse. But in terms of their very long experience there is no reason for them to suppose that it will.

The same is true of genetic information: Let us not forget that the generalities of our behaviour pattern are formulated in terms of our genetic information. This reflects the experience of a far longer period than does the cultural information.

Its main feature is that it is largely non-plastic, i.e., it is not subject to change except over a very long period. If, for instance, it were modifiable on the basis of the experience of a single generation, then the species would cease to display any continuity; it would cease, in fact, to be stable.

When scientific information is built up, this essential fact is not taken into account. The generalities of a scientific model are supposed to be as modifiable as are its particularities, which are supposed to enable those who avail themselves of this information for the purpose of controlling our destinies, to adapt to the most radical environmental changes which a traditional culture could not hope to do. Needless to say, it doesn't work out that way.

A normal organisation of information will contain the optimum, not the maximum amount of information. A system will not develop the capacity to detect signals and interpret them *if it does not have the capacity to adapt to the situations involved, or can only do so at the cost of disrupting its basic structure; which is precisely what its entire behaviour pattern is designed to avoid.*

To change the generalities of a pattern of information and hence to seek to adapt to very radical changes, must lead to precisely this result.

It is clear that the human brain is not designed to contain an objective pattern of information. It cannot handle its generalities.

This explains why scientists are incapable of applying scientific method to the analysis of social questions on which their views are uncritically those of their particular sub-culture.

The objective particularities of their "scientific" world-view are grafted on to the subjective generalities of that provided by their specific sub-culture. (This is particularly clear in the case of Lord Zuckermann's refusal to accept that pollution levels have gone up with industrialisation, and his other argument for still further industrialisation.)

Let us not forget that all behavioural processes, including "learning"

proceed from the general to the particular and once the generalities have been determined during infancy they are very difficult to modify, however impressive may be the scientific arguments produced for this purpose. Thus when a conflict arises, it is the subjective generalities which inevitably prevail and the subjective interpretation of any situation which they provide simply tends to be rationalised in the most convincing "scientific" jargon.

That is why wisdom does not seem to grow with access to scientific knowledge, only ingenuity, and ingenuity in the service of the wrong ideals, entertained on the basis of faulty assumptions, is a liability rather than an asset.

There Is no Mechanism for Making Use of Objective Knowledge for the Purpose of Control

Since the human brain is incapable of containing an organisation of objective information, as is a cultural pattern, objective information if it is to be used must be imposed on the system from the outside. *It cannot be part of the system's normal control mechanism.* But how is it to be imposed? No means is in fact available. Science does not provide a mechanism for ensuring that scientific knowledge *is actually made use of.* Regardless of the amount of objective knowledge available, both individuals and governments will tend to behave on the basis of the subjective information which is part of their phylogenetically and ontogenetically developed control mechanisms. The objective information they will simply rationalise to make it appear compatible with it.

If we have been persuaded that they can, it is that we have wrongly interpreted these particularities in such a way as to make them appear amenable to technological solutions which are the only ones our society can provide, i.e., the solutions which are prescribed by the subjective cultural pattern with which we have been imbued.

If we were to use available objective knowledge we would be forced in fact to reverse practically all existing trends. If we consider the problems that face Man today it can

be shown that all our remedies are counter productive. Poverty for instance cannot be combated by providing people with more material goods.

First of all we are reaching a point where it is increasingly difficult to keep up with the manufacture of these goods. Secondly their provision in the most lavish way has no effect whatsoever in reducing poverty. In America for instance there are 21 million people who are classified as "poor". The reason is firstly that the production of material goods changes the environment we live in in such a way that more material goods are then required. Industrialisation creates needs faster than it can satisfy them. Besides it is becoming increasingly clear that the misery we associate with poverty is the result of biological and social rather than material deprivation, while the production of material goods is the main cause of biological and social deprivation. In the same way, it can be shown that such basic problems as unemployment,²² ignorance,²³ homelessness,²⁴ malnutrition²⁵ and disease²⁶ are on the increase throughout the world in spite of unprecedented investments in technology and industry and that they are not being resolved by technological and industrial progress. *On this basis the whole process should be reversed. If we do not reverse it, it is simply that we are incapable of making use of objective knowledge for the purpose of social control which continues and always will be assured on the basis of subjective information.*

Cognitive Maladjustment

If perception cannot serve as the basis for objective knowledge in normal conditions, in a period of rapid environmental change it eventually becomes even incapable of providing useful objective information. The principle involved I shall refer to as cognitive maladjustment.

It is generally held today that man is infinitely adaptable. This is only because the concept has never been adequately defined. If we define it as the capacity of a system to maintain its stability, then it is

simply not true. Man, by means of science and technology is capable of counteracting discontinuities, but only at great cost. The cost is in terms of reduced stability and hence of greater discontinuities in the future, with which science and technology will eventually no longer be capable of dealing. What, in our industrial society, we take for adaptation, is usually pseudo-adaptation, as Boyden calls it.

The notion that Man is only capable of adapting to that range of environmental changes which can be catered for by a traditional cultural pattern conflicts with the notion that the substitution of a pattern of objective knowledge for his traditional knowledge increases his range of adaptations.

In reality as we diverge from the environment to which Man has been adapted biologically, by means of phylogeny and ontogeny and socially, by means of his society's cultural evolution, and his own education, so are we creating a host of maladjustments at different levels of organisation.

Thus, it is becoming increasingly apparent that a whole new range of diseases is appearing which is un-

known in tribal societies living in their natural habitat — what is more *the incidence of these diseases is increasing with per capita GNP*. I refer to cancer; in particular cancer of the lungs and bowels, ischaemic heart disease, diverticulitis and tooth decay. These are already known among many researchers as the "diseases of civilisation". Boyden refers to them as the "Diseases of Biological Maladjustment."²⁷ They appear to be caused by environmental factors which were absent in primitive conditions, and what is more, the further we diverge from such conditions, as measured by per capita GNP, the greater is their incidence.

It is also becoming increasingly clear that we are faced with an ever increasing range of social pathologies, which were also absent in "primitive" conditions. Their incidence also appears to increase with per capita GNP — I refer of course to crime, delinquency, alcoholism, illegitimacy, suicide, etc. These are best regarded as "The Diseases of Social Maladjustment". Contrary to what many might think, against these ills modern science is impotent. In spite of enormous invest-



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ments in research no cures have been found nor are they likely to be. Remedies provided by science are technological ones whereas *the problems are biological and social ones, requiring biological and social solutions*. Technological remedies do no more than mask the symptoms of a disease thereby rendering it more tolerable and serving in this way to perpetuate it. Their effect is thereby to *accommodate trends rather than reverse them*, to permit in fact a yet further deviation from the optimum environment to which we have been adapted by evolution, and thereby further increasing maladjustments at all levels. This is what happens, for instance, when we fight crime by building more burglar alarms and armoured cars. If a system is limited in its range of adaptations, for somatic reasons, so it is for informational ones. As the relationship between a system and its environment undergoes change, so is its model ever less capable of representing it.

This means that we become ever less capable of understanding our relationship with the constituents of our changing environment, which, to use Forrester's expression is becoming increasingly counter-intuitive.

Thus, whereas our palaeolithic ancestors had no difficulty in understanding what was their relationship with the cave bear and the woolly mammoth, we have no means of understanding what are the implications for us of subjecting our children to X-rays, of permitting a nuclear power station to be built in the vicinity of our homes, of allowing supersonic transport to erode the ozone belt which shields our planet from the sun's radiation, of cutting down the world's remaining stands of tropical forest, of counten-

ancing, in fact, the industrialisation process itself. Few people understand the full implications of these things, and hence, few are capable of reacting or influencing society to react adaptively to the strange new happenings which are rapidly transforming the world we live in.

The result, of course, is that our scientifically influenced behaviour, which, as we have seen, remains based on subjective foundations, becomes increasingly unadaptive.

The Development of Science as part of the Industrial Process

It may well be that these arguments are all of purely academic interest, for the scientific adventure is condemned to failure by virtue of the fact that *it can only occur in specific conditions — those, which in any case, must inevitably lead to the deterioration of the biosphere and if it continues for long enough, the annihilation of complex forms of life, such as man himself*. I have argued elsewhere that there can be no flying saucers, since a planet whose inhabitants have developed the requisite technology, who are in fact technologically several decades, if not a century, in advance of us, would long ago have collapsed from the combined effects of environmental pollution, resource-depletion, starvation and social chaos.

The same argument applies to the development of modern science. It could not have occurred in a hunter-gatherer society, nor in an idyllic rural society, but only as an integral part of that singular process of which technological development and industrial growth are the other necessary ingredients. That scientists, with all their remarkable ingenuity and capacity for improvisation, cannot deal with the problems which this process inevitably gives rise to, has been the subject of this paper. If they have an important contribution to make today it is in admitting their own inadequacies, in informing our political leaders, and the public at large that scientists are not the universal conjurors they are supposed to be.

Scientists must become sages rather than conjurors. They must

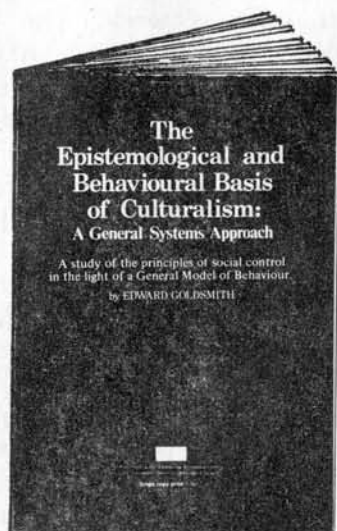
re-assume responsibility for the study of the assumptions upon which their work is based, and organise objective knowledge into something approaching a general model of behaviour. Even if this will never be used to control our society, at least it may help divert the efforts of scientists from furthering the cause of technological development and industrial growth: for it will serve to reveal just how unjustified are such efforts. Further it will demonstrate that de-industrialisation is the only course of action which can be justified on the basis of available objective knowledge.

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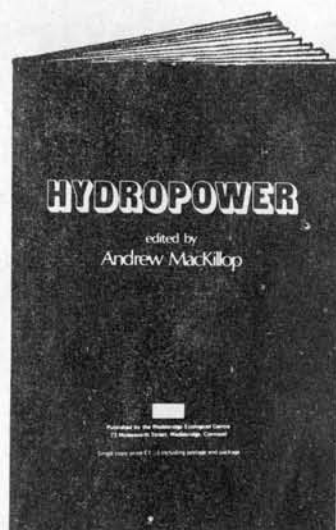
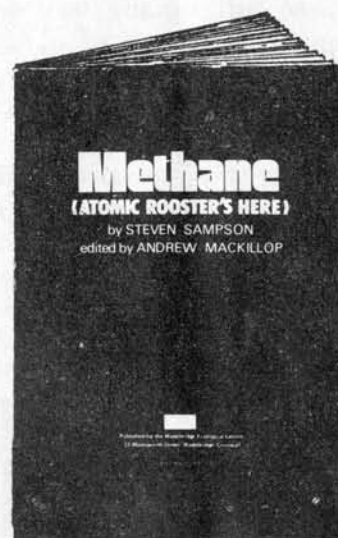
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Reports

ABERFELDY — The Road to Self Sufficiency

One often hears reports of attempts to develop instant self-sufficient communities, e.g., the Commune Movement. But sadly, and almost inevitably, the experiments are short-lived; usually because they consist of people of a narrow age range or who come from different backgrounds. In other words the members of the community were simply not socialised into living with each other in this fashion. So no matter how strong the ideology or spirit may be, such attempts at self-sufficiency which do not fulfill this basic pre-requisite will be vulnerable to problems which would not occur in a stable society. We must therefore be wary of reports from groups proposing to form a community a la Blueprint, "to see how it works".

However, there may now be one example of a community approaching self-sufficiency from a more natural starting point; because the bricks and mortar and, most importantly, the people already exist as an entity.

Aberfeldy is a small town in the Highlands (pop. 1500). It is, perhaps, the first existing town where local people are talking and planning for the day when it will be essential for them to feed themselves from their own locality. Several people including the Provost, the doctor, a grocer, farmers and a councillor have met on an informal basis and agreed that the country faces a serious food shortage. There is a wide range

of views on the implications of such a shortage. Some foresee a total collapse of Industrial Society, others hope that conventional solutions will avert future crises. However, all agree that contingency plans must now be laid for a quick switch over to a self-sufficient market system.

It must not be forgotten that Aberfeldy, and other small towns, were self-sufficient until quite recently. The first blow against the traditional system was struck in 1868 with the coming of the railway. Since then there has been an increase in the population of the town and a depopulation of the surrounding glens, but no great overall change. The traditional market mechanics could be revived relatively easily. For example, the area contains a number of walled gardens for vegetable growing; most of these are now derelict and vegetables have to be imported. The butcher used to sell venison which came from the hills above Tayside, now this meat is exported to West Germany. Milk was once provided by dairy herds in the glens, but these farmers switched over to beef production as a result of government promotion. Milk is now imported from Perth. There used to be an abattoir in the town, but this was closed, cattle now travel to Perth to be slaughtered then travel

back to the Aberfeldy shops.

The local doctor is particularly concerned about the general health of the community, which he sees as being drastically affected by the abandonment of eating local fresh produce. Many factors are involved here; for example, as outlying areas become depopulated the general store and Post Office are forced to close. The food is then distributed to these areas by mobile shop which visits once a week. The doctor explains: "Throughout Scotland the grocers' vans are plying their trade, unloading white bread, margarine, tinned vegetables, tinned soup, tinned meat and processed foods at the cottage doors. Behind the vans come the doctors' cars bearing penicillin, sulphonamide, iron and vitamin pills, while the people break out in boils, get ulcers, festering tonsils and rotten teeth, or in increasing numbers are consumed by cancer. All this in a land where piles of stones and crumbling cottages are monuments in a deserted countryside to a people who once had the vigour to grow all their own food and the raw material for most of their clothing".

Thus while the doctor fears that national food shortages will soon require people to return to their traditional ways, he is keen to educate them to do so voluntarily now.

This months authors

Dr. Peter Springell is a biochemist engaged in research on cattle production in the tropics. He is Chairman of The Capricorn Conservation Council and is connected with a number of other Conservation bodies. He emigrated to Australia after graduating from Cambridge University and his interest in conservation dates from a visit he paid to Cornell University in 1969/70.

G.L.H. Alderson is a specialist consultant on livestock conservation. He is technical consultant to The Rare Breeds Survival Trust and publisher of their journal ARK.

Peter Stables is a young freelance journalist with a special interest in the environment.

E.J. Mishan is a lecturer at The London School of Economics, and visiting professor at The American University, Washington D.C. He specialises in the theory of resource allocation and has written widely on the subject.

The town is also fortunate in having a grocer who owns a water-mill which is still used regularly for grinding oatmeal and other animal feeds. He is well aware of the causes and implications of future shortages and is proud of the role his mill will play in time of crisis and thereafter. He is confident that local farmers will assist by releasing sufficient of their own crops for the local market once the seriousness of the situation becomes apparent.

One hill-farmer, and independent councillor, who will not need any persuading lives a few miles up Glen Lyon. He has arrived at a very perceptive analysis of the rise and inevitable fall of Industrial Civilisation; his future scenario is remarkably similar to that of "Blueprint"; arriving at the same conclusions after following a different line of thought, more intuitive than academic. A few years ago he introduced the

"paddock grazing" method to Scottish hill farms. He now keeps 48 cow units on 33 acres of paddocks. Recently he has abandoned the use of artificial fertilisers but realises that he will have to change his methods much more radically and possibly relinquish some land to city refugees when the crunch comes. He advises that the time is not yet right for the self-sufficiency attempt; by all means discuss and make plans but in the event people will take what steps are necessary to feed themselves. In a living community such as Aberfeldy, people may well cooperate during time of hardship but this counsel is unlikely to apply to the decaying cities where aggression is already at intolerable levels.

Meanwhile other people in Aberfeldy are sceptical, they do not see the need for "turning the clock back", and many claim it

would be impossible anyway. However, the prime-movers of the scheme envisage that shortages of various foodstuffs in the next few years will educate the public far more effectively than political persuasion.

The next stage is another meeting to reach a broader level of agreement and then to bring more community leaders and representatives onto the planning group by holding a public meeting.

Aberfeldy may be going through a very important experience, which could be of value to other small towns to show them how to cope in an uncertain future. It is therefore vital that Aberfeldy is given the right sort of educative publicity, recent reports in the press of "doom valley", etc., only serve to increase most people's scepticism.

Peter Stables

SAID SOMEBODY

Said Somebody:

*The trees, of course,
will have to be chopped down
and we'll build the road
across some farm land.*

Said Somebody else:

*It would be easier to use the cricket-field.
We could build fifty houses there —
back to back, of course.
It's only used in summer anyway.*

Said Somebody:

*There might be objections,
and we've got our Seats to consider.*

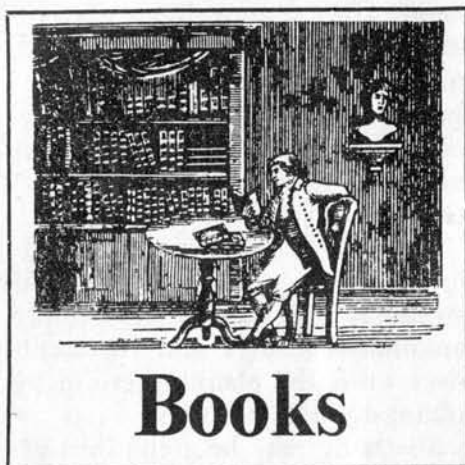
Well, said Somebody else:

*How about that bit of scruffy Green Belt
or the National Trust Park
— or with a wink in the right direction
something could be arranged.
And after all, we do need houses
and laundrettes and pubs and streetlights . . .*

*Trouble is, said Somebody,
they've got their priorities all wrong
— think trees and fields and birds
are more important than rooves
over peoples' heads.*

*If we're not careful, said Somebody,
we'll have the cranks out
with their placards again.
By the way,
does anybody know what 'Ecology' means?*

Tina Morris



IN DEFENCE OF ECONOMIC GROWTH: Wilfred Beckerman: Jonathan Cape, 1974. £3.95

Nothing could be more revealing of the transformation of intellectual opinion in the West than the title of Professor Beckerman's new book, *In Defence of Economic Growth*. Only a decade ago such a title would have been absurd. Among all but a fringe of eccentrics, economic growth was accepted as a self-evident good, as indeed a precondition of continuing social progress. Only in the latter half of the sixties did doubts about its ultimate beneficence begin to spread. Today, the unchallenged presumption in favour of the goal of sustained economic growth has all but vanished. Books like those of Beckerman are now the exception. Perhaps more of them are needed if the anti-growth lobby is not to sink into complacency.

Before appraising the quality of Beckerman's work, let us take a quick glance over the state of the game in the four main areas of controversy. On the broad question of global survival, there is now a consensus that the pioneering work done by Jay Forrester and the Meadows was only a crude beginning. Yet they had the great merit of shocking the public into thinking about the problem, and also of infuriating the economists. The excitement over, economists and others have begun critically to examine such models, and to introduce refinements. But clearly much work has still to be done before limits of different rates and patterns of growth can be set with any degree of confidence.

On particular ecological matters, especially those concerning the capacity of the biosphere to absorb the products of man's intervention on an ever larger scale, the evidence amassed by biologists, ecologists, and others can no longer be ignored by the technocrat. This is without doubt the area of greatest controversy. Scarcely a day passes without some new evidence being unearthed, some new theory being aired, or some older theory refuted or modified. As for the growing risks to which humanity and organised society are exposed by the products of advancing technology — the danger of nuclear catastrophe, of genetical calamity (from thousands of new drugs marketed each year), of ecological disruption (from the trend to monoculture and the consequences of new chemical pesticides), of city havoc (the result of accident or sabotage of any of the vast interdependent public utilities serving the metropolis), and so on — the growthman can do little more than shrug his shoulders, opine that the risks are exaggerated, point to benefits now or yet to come, and affirm his faith in man.

From humble beginnings before the sixties, the environmental movement has grown in strength and confidence, particularly in the United States where it has formed itself into a powerful political lobby. In a number of states it has already challenged, and defeated, highly articulate business interests. In view of the continuing uglification of our towns, cities, and suburbs, (the unavoidable consequence of trying to shape them so as to accommodate the increasing flow of motorised traffic since the war), the environmental movement has an assured future.

Finally, there is the growth debate about the quality of life in a technological society, and whether the good life, any good life, is compatible with the sort of economic growth being experienced in the wealthier nations or, indeed, any feasible sort of economic growth. This I regard as the critical area in the growth debate. For if it were ever agreed that it was indeed possible for the industrialised nations to continue along the growth orbit indefinitely, and while doing so

reduce to tolerable levels the post-war growth of effluent, noise, and industrial overspill, there would still be no sense in continuing unless it were thought likely on balance to improve the quality of our lives in some meaningful sense. It is in this area that growthmen have so far been fighting rearguard battles against a growing disenchantment by the public. No defence of economic growth will make an impact unless it is successful in this area.

Beckerman's book can be divided roughly into two parts. The first four chapters, consisting of about 100 pages, cover the broad issues just referred to; introduction, judgement on the anti-growth fraternity, concepts and measures of real income, the question of needs and welfare, and reflections on the quality of life. The last four chapters (excluding the Conclusion) take up about 140 pages and address themselves to ecological questions, the cost of protecting the environment, and the scarcity of natural resources. The middle chapters, 6 and 7, are on the whole less tendentious than the others, and, since they contain some orthodox economics, can be recommended to serious students along with a caveat to be on the alert for facile reasoning and analogies. Chapters 5 and 8 and also the concluding chapter are polemical. But then Beckerman did warn us in his Preface "I did not want to write a balanced *book*" he wrote, "for what is needed is a balanced *debate*, and so far the field has been occupied largely by the anti-growth cohorts". Whatever else may be said about his book, nobody will charge it with being balanced.

Like Beckerman, I am very much of an amateur in the field of ecology, but I recognize the variety of pollutants that arise from industrialisation, and the risk of damage associated with any one or combination of them, are questions to which we are still seeking answers. New evidence and counter-evidence comes to the fore each day. For every optimistic 'authority' on some ecological aspect, one can also find a pessimistic one. Since nothing conclusive can emerge from the quoting and counter-quoting of selected sources, by two laymen with opposing prejudices, I will confine

myself to two general remarks, and several queries, before turning to the more fascinating, if more elusive, issue bearing on the desirability of continued economic growth.

At times Beckerman puts one off a little by judiciously refuting patently absurd beliefs. There may well be cranks who think that "physical changes in the environment are always harmful" or who "regard the proper objective of policy as being to eliminate pollution entirely" and some others, perhaps, who do not yet perceive that what we call pollutants can be "beneficial or even essential in certain amounts". But it is unflattering to the reader to have the obvious spelled out for him with such painstaking care.

Secondly, his repeated warning with respect to curbing pollution, that measurement must precede action, might lead the innocent reader to believe that Beckerman is the soul of scientific prudence. In the context, however, it is the sort of advice that effectively favours the methodological rule: *so long as the risks of continuing a process are unknown, continue the process. But in some contemporary circumstances, adoption of the maxim, "business as usual until there is clear evidence of adverse spillovers" may, it can plausibly be argued, result in large scale disaster and, possibly, irreversible ecological damage.*

His quotation from Petr Beckmann on page 119 will raise some eyebrows. After telling us (a) that "a single hurricane releases the energy of a 100,000 hydrogen bombs" (b) that a half of all the carbon dioxide in the air is absorbed by the oceans and (c) that volcano ash has been "cleaned up" by nature. Beckmann asks "Can man's puny little carbon dioxide production compete with such gigantic processes as volcanic activity?"

Now I confess that I was unaware that hurricanes produce carbon dioxide in large quantities, and that I had not thought of the 10,800 million tons of man-made carbon dioxide (estimated to have been produced in 1960 by the SCEP Report) as being "puny little", especially in view of the SCEP estimate that the concentration of carbon dioxide in

the atmosphere has been increasing exponentially since 1860. Moreover, in cases where man's production of a 'pollutant' is, as yet, a fraction of nature's output, the addition can sometimes be critical; enough, that is, to disturb ecological balance, at least locally.

Beliefs (or fallacies), such as those in the above paragraph are not manifestly unintelligent, and the reader would be more assured by Beckerman's optimistic arguments if he deigned occasionally to recognise such beliefs. This, however, is not the only instance of his failure to do justice to an issue. At the point where Beckerman alleges that man's emissions of sulphur dioxide have been shown to increase soil fertility in certain parts of the world, the reader would like to know whether the reason for this phenomenon given by ecologists is true; namely that increasing dependence on ultra pure NPK fertilisers has resulted in sulphur-deficient soil — which deficiency, incidentally, could be more economically rectified by adding sulphur compounds to existing fertilisers than by emitting SO₂ into the atmosphere, if only because doing so depresses the yields of other crops.

Again, to take a couple of other examples, we are told on page 123 that "the total quantity of sulphur oxides emitted in the air in Britain has been falling since 1962". But how can such a statement be squared with the figures given in Table 2.4 of the National Survey of Air Pollution, 1961-71 (Vol.1) of total SO₂ emissions of 5.72 million tons in 1962 and 5.95 million tons in 1970? And four pages later Beckerman alleges that the environmental impact of pollutants emitted from high chimneys "is often virtually zero". But the serious reader will be then wondering what to make of the complaints, and the evidence, from Sweden and Norway, that the acid rain which damages their fisheries and forest is caused by the SO₂ from high chimneys in Britain and Germany.

Although we ought now to turn to matters of greater moment, I cannot resist the temptation first to quote just two out of a number of rather curious passages in Chapter 5. On page 135 we again find Beck-

erman quoting from the inimitable Petr Beckmann: "The latest techniques to store radio-active wastes involve so little risk that the probability of accidents is much smaller than the probability of similar damage from, say a fire. For "a five-year-old child can set a city ablaze, but it cannot, with reasonable probability, throw a pound of radioactive wastes into a city's water supply". True, but a fully grown fanatic or urban guerilla can easily do so. And the relevance? Surely, one more instance of the greater vulnerability of urban societies in consequence of technological advances over the past 30 years.

On page 120, the scientific researches of a certain Professor Montrol appear to have culminated in the following discovery, "... that a car emits only six grammes of pollutant a mile whereas a horse, over the same distance, emits about 600 grammes of solid pollutant and 300 grammes of liquid pollutant". It isn't often that words fail me. They do here.

I turn now to some of the broader issues covered in the first four chapters, and discover with satisfaction some useful elementary economics well expounded in the Introductory chapter. The short quasi-philosophical section on 'Needs, Satisfactions, and Welfare' is also well worth thinking about, and I should have been more enthusiastic about it if I could believe what Beckerman apparently believes, that the continuation of economic growth in the West will produce an increased refinement of taste and sensibilities — and not, as I believe more likely, an increase in vulgarization, and the abandonment of traditional restraints on excesses of self-indulgence. For the rest, however, his style of argumentation make it virtually impossible for me not to be unkind, even to a colleague whose professional competence and integrity I respect. But, as I have found out from painful experience, when an academic ventures forth from his special protected area into the public arena he can expect to be subjected to some pretty rough treatment.

Professor Beckerman goes through the motions of a man bent on doing a thorough hatchet job.

And, indeed, he is seen to cut quite a figure so long as he is attacking characters, real or imaginary, who assert flatly that minimising needs is the road to happiness, who believe in all-or-nothing solutions, or who think that a sharp line can be drawn between 'natural' and 'artificial' wants.

It is when he has to face real issues that his show of dash and vigour are under strain. In truth, he succeeds in making so uncertain an impact that even those who would approve his posture as 'defender of the faith' will feel dispirited. Some of them are likely, also, to be embarrassed by his unprepossessing tone. His too-ready recourse to rather unsubtle sarcasm follows the manner of a soap-box orator trying to rouse a disgruntled rabble; to wit, "The middle class, in particular, have always been very hot on morality, particularly when it coincides with their own interests;" (p.24) "The workers . . . are not keen to slow down growth either if this only means helping to preserve the salmon streams and grouse moors of the rich." (p.43). Again, on page 48, he tells us that "A passionate concern with posterity gives one a nice, warm, virtuous glow . . ." and, on the same page, he mocks the anti-growth school with the exclamation: "Back to nature and the old simple life, where workers are respectful and seek no change, where women know their place in the kitchen and the nursery; it has all the familiar ring of Nazi Germany. . . ."

Nor will his gratuitous interpretation of the psychology of "the fellow passengers on the anti-growth bandwagon" endear him much to the fastidious reader. He divides these fellow-passengers into scientists, radical youth, and the middle classes. The aberration of the first group (many of which are "third rate scientists" anyway, as the ubiquitous Petr Beckmann readily affirms) he, Beckerman, finds "easy to understand and forgive". He is no less condescending to "Poor old radical youth" whose "intentions, too, are of the best" (and, inadvertently, condescending also about the British working classes who are, apparently, incurably addicted to beer, fish, chips, and Bingo, and

have no interest in pollution unless it affects them directly in the factory or mine). And although the members of all three groups who have any truck with anti-growth are perceived by Beckerman to suffer from "a guilt complex", the guilt felt by the middle classes is, he calculates, very small compared with their desire to protect their privileges from the new monie multitude.

This example of a failure to come to grips with real issues is typical. Another example is the last sentence of his Preface: "A failure to maintain economic growth means continued poverty, disease, squalor, degradation, and slavery to soul-destroying toil for countless millions of the world's population." This surely is putting it on with a trowel! Nobody denies the plight of the poor countries, and the urgency of effecting some material improvement in the standards of hundreds of millions in Asia, Africa, and South America. The continuing controversy on this problem, however, turns on such things as trade, aid, institutions, and the pattern of economic development in these areas.

In this connection two very pertinent questions can be raised: first, to what extent did economic growth in the West, and the spread of its industry and technology to these areas, themselves contribute to the overgrown populations, and the human pollution and poverty there? Second, will continued economic growth in the West help these countries, as Beckerman assumes, or will it hinder their development? There are economists who argue persuasively that aid, or trade, or both, act to render these countries less self-sufficient, and more vulnerable. For one thing, their exports of manufactures are expendable for the West, and already are subject to a battery of trade restrictions designed to protect domestic industries there from cheap imports. For another, technological innovation in the West continues to produce substitutes for many of the raw materials that make up so large a proportion of their exports.

Finally Beckerman makes much of the fact that there was a great deal of misery and pollution in the

nineteenth century, which is neither new nor surprising since it was a period of rapid industrial change and economic growth. In comparison with the first half of the nineteenth century there is obviously much that is better today. But since Beckerman has only just finished telling us that if things get worse it may have nothing at all to do with economic growth, it ought also to be true if things instead get better. However, the relevant proposition in this connection is the distinction Beckerman himself makes frequently; the distinction between misallocated resources that result in 'excess pollution' and economic growth itself. At any moment of time in the future, present, or past, there can be a pollution problem, that in effect is an allocative problem, one on which the economist has something to say.

But there is more to this and other simple propositions enunciated by Beckerman, than is made explicit in his book. For economic growth — the growth of technology, of industrialisation, and of population — does, indeed, generate an enormity of spillovers such as harmful pollutants and disamenities. And to argue, as economists are prone to do in defence of economic growth, that the resultant spillovers can be corrected by a system of ideal taxes or ideal subsidies is beside the point. For the answer to the question, whether continuing economic growth is likely on balance to benefit society, does not hinge on the economist's perception of ideal solutions or even of 'practical' solutions, but on the political likelihood of such 'practical' solutions being adopted by society. (Thus Freeman and Haveman, in their 1972 *Public Interest* article, "Clean Rhetoric — Dirty Water," concluded that the economist's favourite, the effluent tax, was politically difficult just because it threatened to be effective.) No less pertinent is the undeniable fact that there are crucial human consequences associated with continued technological growth which — whether or not they be classified as externalities — cannot be influenced by economic instruments.

Other simple propositions such as (1) "the only economic cost of

growth that really has to be incurred by any society is the consumption that has to be foregone in order to release resources for investment" (p.28), or (2) that, where there are clearly defined property rights, "increasing demand for materials have always been matched by increasing supplies", or "some other automatic adjustment mechanism has operated" (p.35), warrant closer scrutiny than they receive here.

Proposition (1) is true only if all correction is already made for the proliferation of spillovers created in the process of production and consumption of the range of goods in a modern economy — where the term spillovers has now to be extended to encompass the hazards of rapid change, the strains on family and human relationships, and the disorientation and desolation that are described by Toffler in *Future Shock*. Since these are the chief agenda in the current debate, they ought not to be swept under the carpet at this early stage, for fear of misleading the reader. No spurious distinction between "economic welfare" and "noneconomic welfare" warrants it. There is only a single concept, social welfare, though it is affected among other things by economic factors. And measures of welfare ("economic welfare") based only on the measurable economic magnitudes — such as those reproduced by Beckerman on pages 82-86 — are wholly unacceptable as indices of well-being over time.

As for proposition (2), the notion of a price moving to equate supply and demand looks fairly innocuous. But if the mechanism itself is neutral, the forces acting on it are not neutral and may not be benign. One should not, for example, ignore the billions spent each year by commercial interests in the West in order to persuade people to continue to buy ever larger quantities of 'goods' most of which, it may reasonably be contended, they could live comfortably, perhaps more comfortably, without.

A well-functioning competitive price system is indeed a great boon, as Friedman, Brittan, and others have eloquently argued. But an efficient means can serve unworthy or even iniquitous purposes. It can

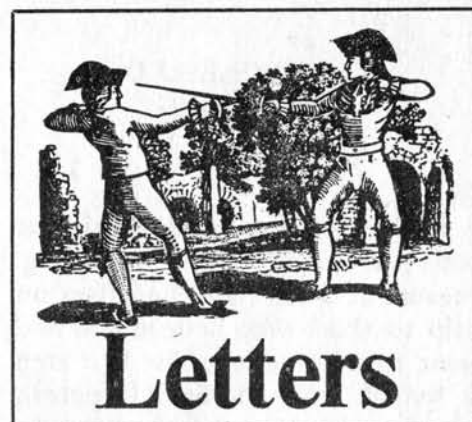
for instance, serve a slave society as faithfully as it can serve a free one, and a siege economy as well as a modern throw-away economy. Thus while growthmen never stop prating of those extra resources desperately needed for more of such "merit goods" as symphony orchestras, higher education, welfare programmes and city parks, there is everywhere on view an incredible assortment of "demerit goods", from porno-sadistic thrillers and exhibitionist attire at one end of the spectrum, to all manner of expensive and expendable knick knacks and technological frou frou at the other.

To conceive of economic growth simply as an engine that produces, "the greatest consumption for the greatest number" is to evade the problem we are required to answer: just what kind of society and just what kind of men and women is economic growth in the West likely to produce?

In truth, Beckerman's optimism is far from infectious. Currently accepted social-welfare indicators offer no vindication of it. Divorce, suicide, homicide, alcoholism, drug-taking, crimes of violence (especially among the young), plus the incidence of blackmail, terrorism, and obscenity, have been growing steadily over the past two decades. Are they connected, and if so in what ways, with television-ownership, with motorisation and increased mobility, with the unending spread and build-up in urban areas, with the stresses produced by exposure to increasing noise, to media, and to the rapidity of change? Are they connected also with the inevitable secularisation of life, with the decline in patriotic sentiment, with the erosion of a moral consensus, and with the new open competitive society that offers no comforts to its teeming millions beyond the hope of worldly success and hedonistic pursuits?

These are just some of the questions that haunt the minds of those who observe the unfolding of events with misgivings. But they are not the ones that trouble Professor Beckerman.

E.J. Mishan
London School of Economics



Letters

TO BE OR NOT TO BE

Dear Sir,

In my article "Is Education Set on a Disaster Course?" (December 1974) there is one serious and misleading misprint. It occurred on page 364 where, speaking of the importance of certain 18th century modes of thought I suggested that "...nothing is more vital to our frenzied, open-nerved culture than to recapture something of that golden mean, with emphasis upon moderate ambitions. . ." In the issue this appeared as modern "ambitions" which is scarcely consonant with the point I was trying to make.

Yours faithfully,
Duncan Williams.
Oxford.

We apologise to Professor Williams for this error and also to Messrs Davis-Poynter, publishers of To Be or Not to Be, from which the extract was taken, for omitting their name at the end of the extract.
Editor.

BRER RABBIT AND THE BRIAR PATCH

Dear Editor,

I feel that the story of Brer Rabbit and the briar patch is an unfortunate one to illustrate Sheila Thompson's point. I take it that she would welcome an escape from what she sees as a Kafka-like bureaucratic thicket. Brer Rabbit, on the other hand, was born and raised in a briar patch; to him it was home. His appeal to Brer Fox was intended to offer to his enemy the worst punishment that could be devised. It worked. Brer Fox threw Brer Rabbit into the briar patch and so Brer Rabbit escaped *into* the patch, not *from* it.

Michael Allaby
Fernleigh Road,
Wadebridge.

TECHNICAL AND TERRIFYING

Sir,

Professor Bryce-Smith's article is both technical and terrifying, because if he is right, he offers no help to those who believe him and want to take action. The first step is to ban lead additives in petrol, increasing costs and fuel consumption, but it would probably be cheaper to stop all private motoring and lead refining than to replace our present sewage and refuse systems, and far more effective.

We absorb 70 per cent of the lead we breathe but only 15 per cent of what we eat. The highest lead in any sewage is at Slough, with 1,200 p.p.m. in the dry matter, but the work of the Grassland Research Station at Hurley shows that only a tiny fraction of this (diluted with 94 per cent of water and spread at 6,000 gallons an acre) is taken up by grass; 95 per cent of this fraction is returned at once in the manure, another 4 per cent is stored in bones we do not eat, and we ourselves take in that 1 per cent of very little in meat and milk. This may still be dangerous to our children, but the lead they breathe can be far more deadly.

Municipal compost is still higher in lead for as newsprint breaks down the 250 p.p.m. in the ink is concentrated, while colour supplements and packaging are far worse with up to 23,000 p.p.m. in some yellow inks (apart from cadmium) and about 4,000 p.p.m. in red inks. Before we spend several £1,000 millions on throwing away plant foods and humus by incineration, we must know how much lead goes into the air we breathe from both this and sludge burning. It is highly important that we should stop industry from polluting our sewage and compelling us to waste nitrogen, phosphorus and potash by draining fertility into the sea. Before we spend several times the cost of the American Space Programme on replacing our sewage treatment, refuse disposal, transport and metal refining plants, we need some serious research.

A crash programme on lead up-

take by crops with and without sewage and its absorption is urgent. There are sewage farms in Britain where 600,000 gallons an acre of lead-rich sludge has been applied every five years for half a century or more, and there are healthy non-criminals who have eaten vegetables off that land all their lives. There is evidence that crops take up more lead through their leaves than their roots, but that this falls off quickly away from the main roads (diesel vehicles puff out carcinogens, not lead), so that the custom of growing cabbages in the back garden rather than the front could cut out a great deal of risk. We need a mass of measurements to establish the relative analysis at various distances.

Through the World Health Organisation there could be a programme of analysis of lead in urine in prisons, reform schools and control institutions where diet could also be tested, at a cost of less than the £20 million that the Government spent on subsidising the dramatic arts in 1974. The whole programme could be carried out for the price of a soon forgotten pay rise in one of the nationalised industries.

It is time that Professor Bryce-Smith forgot his colleagues and his caution and wrote plain English for ordinary people to stir them into demanding the research that would establish whether he is right or wrong. At present he is merely a "Fat Boy Conservationist", after the character in "Pickwick" who "wants to make yer flesh creep", in the eyes of the Borough Engineers of Britain, who have to cope with about 13,000 million gallons of sewage every day.

If the sanity of our children is in danger, then let us sell the paintings in the National Gallery quickly to find out how real that danger is and what we can do about it. It is possible that research on that chelation treatment, investigation into a method of preventing the uptake of lead, cadmium and mercury by crops, and a way of sorting the heavy metals out of sewage and the slurry from a methane gas producing system of refuse treatment might be more rewarding than the collection of still more statistics and references. If only a £50,000 premium bond

winner would put up the money to start some research to find practical answers to the urgent problem of toxic metal pollution.

Yours faithfully,
Lawrence D. Hills

Henry Doubleday Research Assoc-
Association,
Bocking,
Braintree,
Essex.

FOOD FROM THE SEA

Dear Sir,

The timely article by Bondar and Bober ("Should we eat krill?" August 1974) appeared just before a "consultation of experts" convened by the Food and Agriculture Organisation of the United Nations on that subject, at the time of a meeting of its inter-governmental Committee on Fisheries in October. Unfortunately participants were not, I think, aware of the article, nor were the important questions raised in it extensively discussed.

The Federal Republic of Germany should, by the way, now be added to the list of technologically advanced countries with programmes of research on krill with a view to harvesting. The main Russian product now is krill paste — to which there is, apparently, some "consumer resistance" — and the Japanese are marketing it as a form of frozen shrimp.

A more or less independent group of scientists, sponsored by the FAO Advisory Committee on Marine Resources Research and financed mainly by the United Nations Environment Programme, is now reviewing the estimates of the depleted whale resources used by the International Whaling Commission, and trying to evaluate the ecological relationships of the whales with their food supply and their competitors. It is true that existing data are tenuous; on the other hand it is clear that catch rates of krill would have to be very much higher than by present methods, not only for economic operation, but also to compete with the rate of catch that could eventually be taken with equivalent effort from restored whale stocks.

The need for a long-term programme of research on cetaceans, especially of the large whales, has

now been internationally and officially recognised. During an "International Cetacean Decade" it will be necessary to monitor Antarctic whale populations independently of any continuing data from the drastically cut-back whaling operations, and it has been suggested that specially chartered vessels might be used for this purpose, under the aegis of UNEP.

Yet, less biological oceanography is being done now in Antarctic waters — apart from basic studies near the ice edge by Antarctic expeditions, and the narrowly conceived krill exploration — than before. It seems reasonable to suggest that a large scale investigation of the Antarctic marine ecosystem should be launched as a combined operation.¹ But why, some ask, should this be done by international organisations? Why not — even cooperatively — by the nations that are already interested in and able to mount such programmes? I have tried to show elsewhere why it should not be left entirely to them.² Briefly it is because, even if the UN Conference on the Law of the Sea leads to agreement for a 200 mile wide Exclusive Economic Zone the living resources within which are under the jurisdiction of the coastal state, some of the "unconventional" resources such as squid, lantern fishes and krill will be beyond that zone. How much will be outside, and how much within, we cannot say, because we do not yet know the geographic distribution of the resources, and there are also large uncertainties as to the eventual frontiers of a hundred or more EEZ's and an international or "high seas" zone.

Further, since interested states have, under the Antarctic Treaty, until now held in abeyance their territorial claims on that Continent, the eventual status of the ocean area up to 200 miles offshore from it is anybody's guess. Ominously, some Parties to the Antarctic Treaty are now showing interest in the mineral resources of the continent itself — including huge reserves of offshore oil — and we cannot assume that the territorial claims will remain dormant.

So, observing that most of the nations now interested in krill are

among those whose fleets depleted the whale stocks, and whose populations are not evidently short of protein, it seems in order to suggest that research and development on krill, and other biological resources of the Antarctic — including the whales — should be overseen by some organisation responsible to the world community as a whole, including the developing nations whose people now consume neither whale products, nor krill, nor other items from one of the main marine resources in the Southern Hemisphere. The cooperation of the powerful nations, and of such specialised organisations as the IWC, will of course be desirable, even essential, but there seems to me to be an overwhelming case for a substantial international research operation in addition. To mount this the assistance both of UNEP and the World Bank and other funding organs of the UN system should be sought. To plan it, those non-governmental international organisations which have long been interested in Antarctic problems should be involved: the Scientific Committee on Antarctic Research and the Scientific Committee on Oceanic Research (both parts of the International Council of Scient-

ific Unions) and the International Union for the Conservation of Nature and Natural Resources. A useful lead has also been given by Unesco's Intergovernmental Oceanographic Commission, whose International Coordination Group for the Southern Ocean recently reported that it "shared a growing and world-wide concern regarding the impact of uncontrolled exploitation of krill, pelagic fish and other living resources . . ."³

Meanwhile environmental interest groups should perhaps press, if not for a moratorium on krill harvesting, at least for the early establishment of a rather low international limit to the annual experimental harvest, pending better understanding of the situation. If, as seems possible, the International Sea-Bed Authority being negotiated by the UN Conference on the Law of the Sea, also has some responsibility for administering certain other aspects of the use of ocean space, it could be an appropriate body to implement such restraints, either directly or through an Agency such as FAO.

S.J. Holt,
Professor of International Ocean Affairs,
Royal University of Malta



INTERNATIONAL ZOO NEWS

The magazine which brings you the latest news from zoos all over the world, including births and hatchings, developments in wild animal husbandry, and a regular feature on conservation, with up to the minute news from IUCN and the World Wildlife Fund.

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CONFERENCES

THE COUNCIL FOR SCIENCE AND SOCIETY

is holding an

OPEN FORUM

on Saturday, 3rd May, 1975 at Conway Hall, Red Lion Square, London, W.C.1., from 10.00 a.m. to 5.00 p.m.

on

"NEGLECTED RESEARCH AND SOCIAL PRIORITIES"

The priorities of human need are not always matched by the allocation of scientific research effort. The Open Forum will start a public discussion about this, with reference to real cases.

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There are at every level of society individuals and groups experimenting, reaching out towards new forms of social organisation, new forms of education, new forms of political structure and new kinds of community. Alternative Society organises weekend meetings, Summer Schools and Summer Camps.

For further details contact Stan Windass, 9 Morton Ave., Kidlington, Oxford. Tel: Kidlington (08675) 3413.

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RESIDENT HOUSEKEEPER required by The Theosophical Society, 50 Gloucester Place, London W1. Tel: 935 9261. Reference GW8.

Group planning to purchase 100 acres to farm organically and create a co-operative, community endeavour for all to work together and find common purpose for the future, need someone to help with an interest free loan to enable start. Bridge Trust, 20 The Chase, Reigate, Surrey.

UHURU is the Swahili word for freedom. In Oxford Uhuru is a shop where they sell handicrafts and whole foods. 35 Cowley Road, Oxford.

TRANSPORT ACTION GROUP exists to promote alternatives to the present mad transport system. 45 Lowerhouse Lane, Burnley, Lancs.

GURDJIEFF, OUSPENSKY, NICOLL. If you have a real wish to participate in an established Group, write BOX NO. PD47.

CLAP. Have you paid your clap tax? CLAP, the Community Levy for Alternative Projects, is a tax on up to 4% of your gross income - minimum £1 every two months - and up to 100% of your unearned income, inheritances, windfalls et al. If you have any kind of income, please do not avoid paying this alternative tax. How else are we going to help build up and sustain a network of alternative structures for the sane transformation of society? Send 14½p in stamps for the CLAP Handbook which is a good read in its own right - if you wish, you then choose which of the projects described to support. Or does your project need money? If it's community-based, imaginative, evolutionary or whatever, send for details of how to apply CLAP

c/o BIT Free Information & Help Service, 146 Great Western Road, London W11. (Tel: 01-229 8219).

PUBLICATIONS

Childrens Community Centre (see Living with Children. Resurgence Vol.5.no.2). They have produced a bulletin on how they established the centre, the arrangement of the house, the relationship with the neighbourhood, the children and parent involvement, sex roles. A practical guide at the end covers how to get money, how to find premises, insurance, rates, free milk, free and improvised materials. 15p from 123 Dartmouth Park Hill, London N19.

AT THE FARMER'S SERVICE 1974/75

The latest edition of At The Farmer's Service is now available. This pocket-sized booklet gives information about various services and facilities provided by the Ministry, together with brief details of the grants and subsidies available to farmers and growers. It is divided into sections, under various sub-headings, for easy reference. The booklet contains addresses of local Ministry offices from which further information can be obtained. A single copy of this booklet may be obtained free, from Ministry of Agriculture, Fisheries and Food (Publications), Tolcarne Drive, Pinner, Middlesex HA5 2DT, or from any of the Ministry's Divisional Offices. Prices for larger numbers will be given by the Pinner office on request.

THE ARK is a monthly magazine about endangered species of domestic livestock, and the activities of the Rare Breeds Survival Trust. Each issue contains a variety of articles ranging from scientific to human interest. To obtain copies of our four latest issues send £1.00 to: The Ark, Box G75, Winkleigh, Devon, EX19 8SQ.

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These young workers who wish to appear emancipated, westernized and "clever", set up their enterprises in the towns where, if successful they become influential advocates for rapid growth and "industrialization at any cost". Rarely do they invest in their own "backward" villages (which they now often despise) - if they do, it is only for their own and their families benefit, and they behave as if their knowledge of industry and modern technology cannot and must not be questioned by their ignorant fellow villagers who have not "seen the world".

In Turkey there is a small group of "Ecologist" readers who believe that the fastest way to make people in the developing world ecology-conscious (to the ultimate benefit of us all!) is to give the young students from these countries a chance to stay with a stable family sympathetic towards environmental and ecology issues for at least a year, being treated as a family member and able to attend English classes regularly in a nearby good language institute.

The fees for language education will be paid by sympathetic "ecologists" in England and out of funds scraped together by the village families of the candidates chosen (by British subjects) a modest board and lodging charge can also be met. It is hoped, however, that prospective host-families will not feel they are offering a charity, but rather that theirs is one of the many contributions to a sounder world we can all make in our different ways provided good will is there.

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Declining fertility, increasing resource prices, and shifts in social preferences are among forces that may bring marked reductions in demographic and material growth to many nations by the year 2000. The transition to a steady-state, sustainable society can offer many opportunities for constructive social development, if appropriate foresight is exercised to avoid the problems inherent in any profound social change. The Mitchell Prize has been established in collaboration with The Club of Rome to encourage international analysis and solution of problems that

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The papers submitted for consideration should adopt a focus of relevance to policy makers who are cognizant of their own country's interdependence with a global society. The time perspective of the analysis should extend through to the end of current growth trends, approximately 40 years. Papers should concentrate on some specific set of social, institutional, psychological, political or economic consequences of declining growth rates and describe alternative research programs or

policies that could alleviate their negative effects.

The awards will be made at the international conference, "Limits to Growth '75: First Biennial Assessment of Alternatives to Growth," which will be held at The Woodlands, Texas, October 19-23, 1975. The Conference is being sponsored by The Club of Rome, the University of Houston, and Mitchell Energy & Development Corp. The awards are being sponsored by George and Cynthia Mitchell of Houston, Texas. For further details and application materials, write:

Limits to Growth '75 5645 South Woodlawn Avenue Chicago, Illinois 60637 Application deadline is January 31, 1975.

Limits to Growth '75



Deadlines:

Application Extended to: Feb. 28, 1975

Summaries of papers: April 20, 1975

Final papers: Sept. 15, 1975