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Ecologist

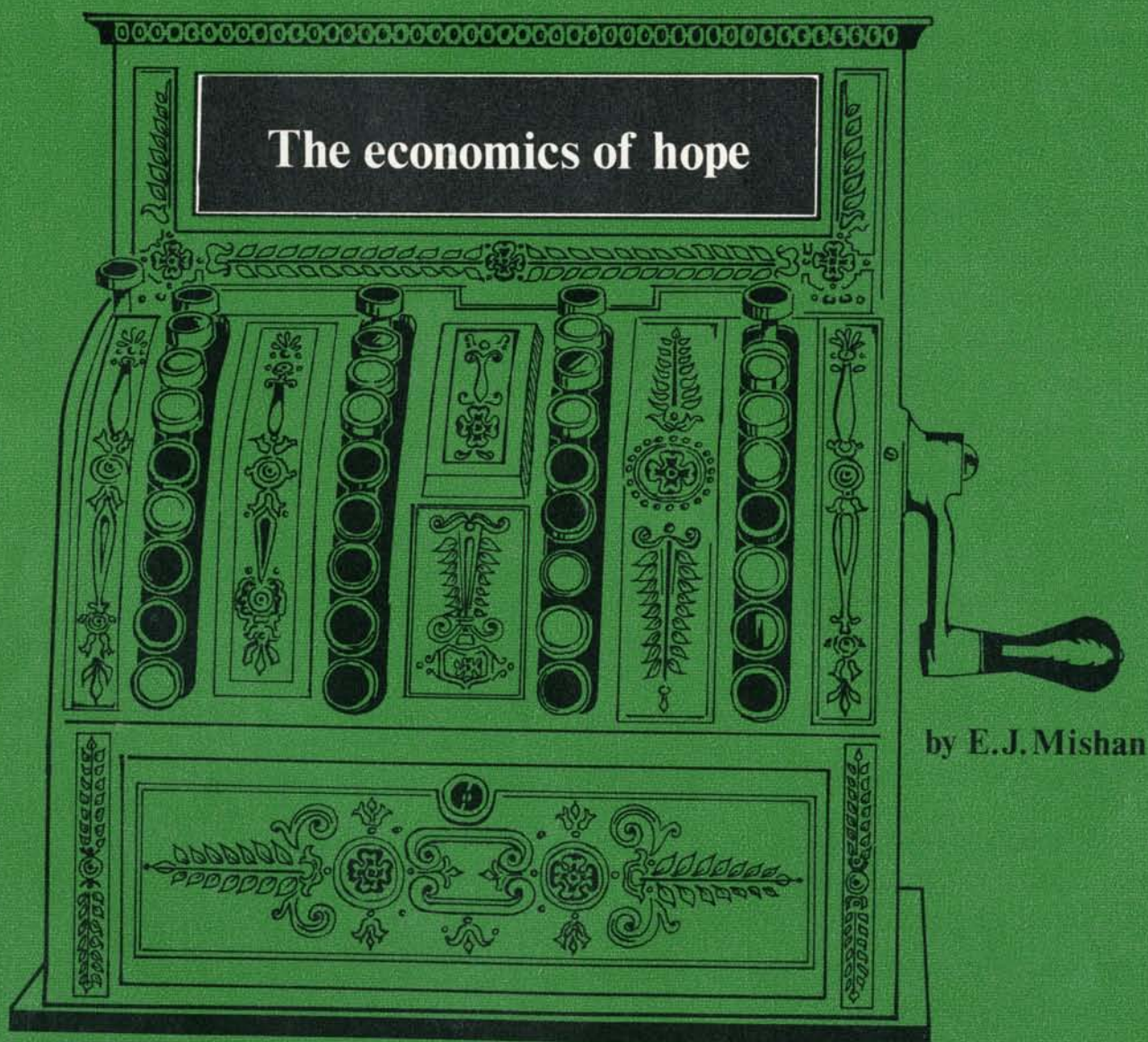
Man and the environment ■ The Quality of life ■ Pollution ■ Conservation

Vol. 1. No 7

January 1971

Birds of prey ■ PCBs in the dock ■ Opencast clean-up

Student action ■ The revolution to come



by E.J. Mishan

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Biological Conservation is devoted to the scientific protection of plant and animal wildlife and all Nature throughout the world, and to the conservation or rational use of the biotic and allied resources of the land and fresh waters, sea and air, for the lasting cultural and economic welfare of Mankind.

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The Ecologist

Vol. 1. No. 7 January 1971

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Needless to say, this animal has been blessed with neither a soul, nor a mind. Nor does he have the gift of language, nor the capacity to formulate abstract ideas; and his acts, rather than be free, reasoned and intelligent, are but the product of blind and irrational animal instincts.

As a result, he has not achieved that level of civilisation that requires the poisoning of vast masses of fellow animals to increase the yield of crops, the imprisonment in foul concentration camps of millions of others so as to reduce the price of meat, nor the asphyxiation of aquatic life that its habitat might serve as a receptacle for the waste products of civilised-life-processes.

Indeed, how fortunate is the world that we, his distant cousins, should have been singled out from among so many other creatures as the privileged recipients of these unique blessings.

Editorial

Our fatal illusions

It is basic to the culture of Western man that, rather than being part of Nature, he is above it. This leads to the preposterous notion that his behaviour cannot be subjected to the sort of scientific analysis used to understand the behaviour of other forms of life. Whereas atoms, molecules, cells, even complex multicellular but non-human animals, can be described in the comparatively precise terms of physics, chemistry, biology and cybernetics and it is possible to describe them in such a way as to permit the prediction of their behaviour, it is widely believed that human beings and the societies in which they are organised can only be described in terms of a much vaguer language, that of the humanities, and that the precise prediction of their behaviour is not even remotely conceivable. We justify this thesis by establishing all sorts of totally artificial barriers between man and other forms of life.

For instance, we consider that we have a soul, which other animals do not possess. This has been used as an excuse for condoning the tyranny we have exercised over all other animals. We are meant to possess a "mind", which can only refer to the mechanism controlling our behaviour. This can only be a control system which not only men but cells, molecules and atoms must also possess, though theirs may be of a less differentiated kind. Our behaviour is supposed to be "rational" whereas that of other animals is "irrational" once more, a concept that has never been properly defined. The only functional definition of a rational act would be one that was consistent with a particular model or hypothesis, i.e. that was predictable as opposed to being purely random. If this definition is accepted, it can be shown that ordered behaviour at all levels of organisation is "rational", "irrational" behaviour only occurring with disorder, i.e. with the disintegration of the system.

Man's behaviour is supposed to be

intelligent, whereas that of other animals is the product of blind instinct. Once more, the term "intelligence" has never been properly defined. If it is taken to mean the ability to handle high-value information, (in the sense in which the term "information" is used in communications theory) then it can be shown that this increases gradually as animals ascend the ladder of life. It is undoubtedly higher in human beings than in any other animal, but again it is simply a matter of degree.

The Freedom of the will

Man is also supposed to have free will. He displays choice. Other animals, whose behaviour is governed by blind instinct, do not have this freedom and cannot display such choice. The implication of this is, of course, that one cannot predict man's behaviour like that of other forms of life, which means that scientific analysis cannot be applied to it. Tinbeyer and others showed that behavioural reactions are mediated by a hierarchical organisation of behavioural centres. The most general instruction is mediated by the most general behavioural centre and transmitted down the line to progressively less general ones, where they are further and further differentiated. Which part of the hierarchical organisation is taken as being the will? Whatever the answer, none of the decisions taken are free, if by free is meant not subjected to constraints, as each instruction is subjected to the accumulated constraints of all the preceding ones. The notion of the freedom of the will is, therefore, either meaningless or false, depending on how one wishes to define one's terms.

Our culture is above all others

A further illusion is our firm belief that our culture is above all others, rather than one out of many thousands. It is only by examining all the different cultures so far developed by man that it is possible to produce a theory of cultural behaviour and it is only in terms of such a theory, i.e. cross-culturally, that other cultures must be judged. We, on the other hand, insist on judging them in terms of our own culture. For instance we consider that polygamy and nudity are immoral, head-hunting barbarous, initiation rites cruel, while ancestor worship is simply sheer superstition. Consequently they

must all be suppressed, regardless of the function they fulfil within the cultures of which they are indispensable parts. It is because of this "sociocentric" way of looking at other cultures that we tend to destroy and assimilate them, with the resulting social chaos. At the same time many of the disciplines that we develop to deal with different aspects of cultural behaviour are totally distorted, being based on information and making use of classifications peculiar to our own society. A typical example is modern psychiatry, whose tenets would not survive serious cross-cultural analysis. For instance, types of behaviour that are regarded as pathological in one society are quite acceptable in another. To quote Hollwell: "There are societies in which homosexuality has been culturally integrated, others in which it is suppressed with vigour. We know cultures in which disassociative psychic states or hysteria have been one qualification for religious leadership, or even sainthood, and with the latter we might contrast societies where there are no culturally approved channels for the expression of such psychic phenomena outside of a mental hospital."

Each society appears to have a different pattern of mental illnesses. Schizophrenia, for instance, appears to take a very different form in Italian and Irish patients, it is also much rarer in primitive cultures, among whom we also find an absence of manic depressive psychoses. Sexual perversion appears to be high in Iran and correspondingly low in Hong Kong. Obsessional neuroses are very low in Formosa, Kenya and Kuwait, conversion hysteria high in Ireland, Greece and Italy. It must be clear that were a school of psychiatry to be established in each of these countries, taking into account only data obtained locally, it would provide a very distorted view of human mental disease. This is clearly so with that which has been developed in our own Western society. It can easily be shown that the same can be said of such culture-bound disciplines as the study of government and religion, psychoanalysis and economics, as well as countless others.

Clearly, if we are to develop a body of theory that will enable us to understand the world we live in we must abandon the fatal illusions that man is above nature and that Western man is above other men.

The economics of hope



by E. J. Mishan

Edward Mishan was educated at Manchester, London and Chicago (where he took his doctorate in economic theory). He has been on the faculty of the London School of Economics since 1956. At present he is reader there, and visiting professor at The American University, Washington, D.C. He specializes in the theory of resource allocation and cost-benefit analysis. He has recently published two popular books, *Growth: The Price We Pay* (Staples Press), and *Twenty-One Popular Economic Fallacies* (Penguin).

Strong anti-disamenity laws are essential if the economists are to play their part in ensuring that social and environmental well-being is no longer sacrificed to productivity.

The popular image of the economist appears to be that of an apologist for the economic "Establishment", a sort of intellectual descendent of Gradgrind, whose main occupation is that of scrutinising the indices of employment, exports, interest rates, and, of course, economic growth. By reference to such indices alone, it is thought, and quite impervious to the changing features of the world about him, he forms solemn judgments about the nation's prospects, and concludes either that the economy is "sound"—and, therefore, by extension, the state of the nation at large—or, much more frequently, that it is unsound.

That there are such people in our midst is certain. Some are the spokes-

men of our great industries. Some are to be found among our financial journalists, highly skilled in this art of "index economics" and conditioned over time to rejoice at detecting an upturn in any economic indicator and to lament at detecting a downturn. Too many of such watchdogs are yet to be found among government ministers and senior officials. For there is no easier way to earn a reputation for prodigious commonsense and non-sense realism than to be seen bustling about the country, bursting with the latest statistics, warning against complacency, and exhorting the business community to greater feats of productivity.

But the economist, as scientist at least, has no commitment to objectives connected with economic growth. Some economists approve of such policies, some do not. But whether or no, there is nothing in economic theory that can be adduced to support either growth or anti-growth.

Back to Mill

It so happens, however, that a lively interest in what we now call the quality of life can be found in the writings of many of our great economists. John Stuart Mill is frequently quoted in the conservation literature, but apposite quotations could also be culled from the writings of a number of other famous economists, Marshall, Pigou, Keynes, Knight—to mention only those that spring to mind—who have inveighed against the mere pursuit of materialism in disregard of the social consequences. Indeed, in the last decade, and contrary to popular belief, a number of professional economists in

this country and in the United States have been in the forefront of the battle against the mounting spill-over effects of indiscriminate economic growth. And there is an increasing number, at present less vociferous, but in close sympathy with the growing concern over the last few years at the noise, filth, congestion, and environmental destruction that appears to follow inevitably in the wake of rapid economic growth. What is more, the economist has a distinct contribution to make. Compared with the contribution to be made by the ecologist, it is, perhaps, limited. But it is by no means parochial.

Restoring perspective

The economist can attempt to restore perspective, casting doubt on the need-to-grow thesis and on the significance of indices of national income; he can, by reference to economic concepts, promote an understanding of the social problems posed by pollution; he can examine the economics of the alternative solutions proposed. Let us consider each facet of this possible contribution in turn.

With the rapid growth in the popular channels of communication it is more true than ever it was before that the sheer weight of reiteration rather than the power of reason influences the attitude of the public. A simple term such as "growth potential" is loaded with compulsion: it suggests that waste is incurred whenever we fail, as we invariably do, to realise this potential growth. It is a term apt to the technocratic approach, that envisages the country as some sort of vast powerhouse with every grown man and woman a potential unit of input to be

harnessed to a generating system from which flows this vital stuff called industrial output. And since this stuff can, apparently, be measured statistically as Gross National Product (GNP) it follows that the more of it the better. Viewed as power-houses for the generation of GNP, some countries appear to perform better than Britain. It is then inferred that we must make every endeavour to catch up, otherwise we shall be "left behind in the race". Once it is discovered that, say, America uses more engineers, or has more Ph.D's, per million of population than we do, the cry goes out that we *need* at least *x* per cent more engineers and *y* per cent more Ph.D's if we are to "compete effectively in the modern world", or "break into the 20th century"—or any other journalistic cliché indicative of thrust or go-go.

And so we go on; steel output could, if we tried hard, rise to *z* million tons by 1980, as much *per capita* as the United States has now. In consequence, we *need* to expand steel capacity by *w* per cent per annum. With such "needs of industry" to be met we shall require increased commercial transport. We shall therefore require more roads, more fuel imports, and so on, in consequence of which we shall *need* to work harder in order to pay for these future needs. Thus, we progress from implicit choices to explicit imperatives.

It would be futile, of course, to suggest that we should be thinking of the possibilities of reducing the working day. How could we possibly hope to compete in world markets? What choice have we but to return to the treadmill.

Do we have a choice?

This is a sad state for any nation to be in, and in an affluent society surprisingly strange. Having come this far into the 20th century, with business economists interpreting the alleged increase in our national income as "enrichment" or, more sagaciously, as "an extension in the area of choice", and then to be told almost twice a day that we have no choice; that if we are to pay our way in the world we have to work harder. It is enough to tax the credulity of any being whose judgment has not yet been swept away by the torrents of exhortation.

But of course we have a choice, a wide range of choice. The so-called policy of economic growth as popularly

understood is little more than a policy of drifting quickly, of snatching at any and every technological innovation that proves marketable with scant respect for the social consequences.

In the formulation of the ends of economic policy, the word *need* is not to be invoked. Markets do not need to be expanded—although, of course, businessmen dearly *like* to see them expand, whether through a rise in *per capita* income or through a rise in domestic or immigrant population. And it is a sad and surprising fact that governments today have not yet weaned themselves from the habit of equating the "needs" of industry with the well-being of society. Indeed, it is entirely possible to so arrange things as to produce fewer gadgets and to enjoy more leisure. Though blasphemous to utter, it is also possible to train fewer scientists and engineers without our perishing from the face of the earth. We might even enjoy life better. Nor do we need to capture markets in the hope of lowering costs, or to lower costs in the hope of capturing markets. We can quite rationally and deliberately, choose to reduce our foreign trade and to produce smaller quantities of some goods, possibly at higher cost. We can decide to reduce the strains of competition and opt for an easier life. I do not argue that this is a better policy; only that such choices and many others can be translated into perfectly viable alternatives if ever the public is prepared to consider them.

A quieter economic life

The choice of a quieter economic life does, however, imply turning our backs on GNP or any other indicator of national product. I need hardly argue in this magazine that GNP is not to be viewed as a measure of gross national achievement. Neither is it, contrary to the impression conveyed by newspaper editorials, an index of civic virtue. On the contrary over the last 20 years or so, it is probably the best index we have of gross national pollution.

What it purports to be is an indicator of what Professor Boulding (of Colorado, USA) has called "throughput", an index of the resources we have destroyed during the year (allowance being made for some addition to the stock of capital). On a biased view (biased because technological innovation is ignored) the faster we consume the earth's resources the higher the

index of economic growth. Regarded as an index of social well-being, either on an aggregate or on a *per capita* basis, it is also perverse. Does anyone really believe that the average person or family in the US is two and a half times as contented or "fulfilled" as the average person or family in the UK? If we increase our leisure, GNP declines. If resources are directed to producing fewer "goods" and towards combating an increase in the incidence of crime and disease, there is no reduction in GNP.

Indeed, an increase in the numbers killed on the roads, an increase in the numbers dying from cancer, coronaries or nervous diseases, provides extra business for physicians and undertakers, and can contribute to raising GNP. A forest destroyed to produce the hundreds of tons of paper necessary for the American Sunday editions is a component of GNP. The spreading of concrete over acres of once beautiful countryside adds to the value of GNP. The destruction of historic buildings or parts of a hamlet in order to make room for a new road or supermarket takes its place as a positive item in GNP. The night flights that make some people's life a virtual nightmare is an essential component of GNP, as is the output of the industrial processes that daily pour their effluent into the air and into lakes and rivers. And so one could go on.

Refining the GNP

It is for such reasons that economists, particularly in the United States, are increasingly dissatisfied with the use of GNP as an index of anything save crude output. They are preparing to refine it by subtracting from it components that are effectively, "intermediate goods" and not final goods,¹ and by subtracting from it the incidental outputs of "bads" or pollutants. They are proposing also to supplement it by other, more direct, indices of social welfare, such as those purporting to

¹ For instance, subtracting expenditures on internal and external defence that can better be regarded, not as final goods wanted for themselves, but simply resources spent in promoting the conditions necessary to production and consumption. Another example would be the removal from GNP of expenditures used up by workers, personnel, and businessmen simply in commuting to work. When GNP is trimmed down to size in this way, it is surprising how unimpressive the progress over the past half century looks.

measure the incidence of crime, violence, divorce, "drop-outs", drug-consumption, to mention just a few.

The economic approach to problems of pollution differs—in degree rather than in kind—from that of the ecologist in that it is limited to the foreseeable and more tangible consequences of economic activity, in particular to those consequences to which money values can be assigned. Though this does indeed impose limits on what the economist can say, the mere fact that he can translate the effects of his proposals into sums of money assures him of a respectful hearing in a society such as ours, readily impressed by figures.

The principle on which the Western economist attributes values to the by-products of economic activities is no different from that used in evaluating goods in general. Accepting the dictum that each man knows his own interest best, he goes along with the attitudes and the existing tastes of the community. The value, then, he attributes to any good or new acquisition is the (maximum) sum a person is willing to pay for it; and to any "bad", or loss of a good, the (minimum) sum a person is willing to accept as compensation for bearing it. Although this routine procedure, I am aware, must appear of limited relevance, if followed consistently it can lead to quite sensible proposals, as we shall see later. For a century at least, the economic concept of a spillover effect—the unintended by-products, good or bad, of otherwise legitimate economic activity (of which ecological consequences form the broadest class)—has exercised the minds of economists. In particular, since the war there has been a marked proliferation of economic literature on this subject, part empirical but mainly theoretical, and of uneven quality and relevance.

The reader may well wonder why it is that these developments have not, then, been brought more forcibly to the attention of the public. There can be more than one reason, and it is revealing to discuss some of them.

Spillover

First, the professional economist has until very recently concentrated largely on spillover effects within an inter-industry context. The favoured examples are those spillovers produced by one industry or firm that fall on another industry or firm. These inter-firm

or inter-industry spillover effects are easier to calculate than those suffered by the public at large, and schemes for adjustments are more feasible as between organized groups than as between an unorganised public, on the one hand, and the industries in general, or the users of their products, on the other.

Secondly, the professional economist, before the war at least, regarded these spillover effects as merely one among several factors—such as the degree of monopoly in industry, or the incidence of taxes and subsidies, or imperfect mobility and information—that stood in the way of an ideal solution to which, at any moment of time, the economy was moving. They were regarded more as one of the standard obstacles in the construction of quasi-mathematical optimum systems, rather than as an urgent social problem. And in economics, far more than in the physical sciences, immersion in pure theory is a sure way to lose all sense of proportion. No empirical restraints intrude and, more often than not, effects of the greatest social significance are cast down by the merest shadow of an improbable relationship.

The cost of cleanliness

Thirdly, there is the undoubted difficulty of measuring the damages suffered by the public at large. The additional cost of keeping one's clothes and person clean in a smoke-polluted area can be estimated without too much difficulty and added, along with such costs for all other persons, to the commercial costs of producing the goods in question. The costs of water-pollution by one or more factories is also amenable to measurement wherever the authorities have estimates of the damages caused to other industries or to fishermen. But the major social afflictions such as industrial noise, dirt, stench, ugliness, urban sprawl, and other features that jar the nerves, offend the sight, or in general assault the senses and impair the health, are difficult to measure and to impute to their respective sources—which is, of course, no reason for treating them with resignation.

Finally, and perhaps most important of all, there are proponents of *laissez-faire* still at large who argue that nothing need be done. Given enough time and, presumably, enough forbearance, things will sort themselves out; that is to say, if the spillover is "uneconomic"

it will be eliminated sooner or later. And if it persists, the presumption is that, after all, it is not "uneconomic".

Let me illustrate this line of reasoning by reference to a private airport. It may well be that the families residing in the neighbourhood could together raise a sum that is more than enough to compensate both the airport authorities for moving to another site and local businessmen anticipating profits from consequent development. But under existing institutions the initiative for bringing about such an arrangement is not available. Even if it were, the incidental costs of estimating and ensuring a fair contribution from each of some several score thousand families would be prohibitive. In the event, the potential economic improvement does not take place.

But then, says our *laissez-faire* friend, this result is just what it should be. For the costs of estimating and securing a fair contribution from all these families, the costs of negotiating with the airport authorities, the costs of legalising such agreements and so on—call these *transactions costs*—are not imaginary costs; they are real costs; they use up scarce time and resources. And since transactions costs exceed the potential gain of moving the airport elsewhere, there is on balance a net loss in doing so.

But this inference is far from being conclusive. Indeed, a little reflection reveals the argument to be double-edged. For if existing laws were devised to protect the amenity of citizens, then all the costs incidental to a change (by mutual consent) in the *status quo* would have to be borne *not* (as at present) by the victims of spillover effects, but by the creators of spillover effects. Under such a law a wide range of activities from airline flights and automobile traffic, to chemical works and package tourism, would be drastically curbed—and resources released for the production of other non-polluting goods and services.

In equity there is a strong case for such laws, and it is only the fact of their non-existence that poses for the community an artificial problem. For in the absence of such amenity legislation, not only do the costs of compensating the polluting industry fall on the victim, but the full *transactions costs* also. If, on the other hand, anti-pollution measures are to be financed by the public, the proposal meets with polit-

ical resistance. Taxpayers, it is pointed out, are not keen to have their burdens increased. Commissions are then set up by governments and local authorities, editorials are written calling for more research by scientists and industry, and so things continue much as before.

Industry must control its pollutants

Clearly, if the responsibility for a range of pollutants, including noise, were instead put squarely on the shoulders of the perpetrators, the problem would be much more amenable. Industry would have an immediate incentive to discover the cheapest method of controlling its pollutants, since the alternative would be either to compensate all legitimate claimants or to close down. The burden, that is, would be shifted at once on to the industries responsible and any additional costs would, in time, be shifted on to those using the products of such industries.

I emphasise the case in equity, since the apparent dilemma—to have people lose sleep or to have the country lose money—arises, in the last resort, from the government's quite cynical disregard of the physical and mental suffering caused by promoting traffic and other developments. The growth in night flights is only one of the more blatant instances in which, in our so-called affluent society, large numbers of innocent people are made to suffer so that others have additional opportunities to pursue profits and pleasure.

This situation, however, did not affront the conscience of our socialist ministers, and there is no inkling that it causes any pangs to existing ministers of the Crown. I shall be impertinent enough to suggest that if the nightly slumbers of the members of the front bench or of their children were persistently disturbed by aircraft noise we should get immediate action. But while it is only others that suffer, the law protecting the airlines continues. Priority is given to technology and commercialism; not to considerations of right or of social justice.

The pre-condition, then, both of social justice and of good economic allocation is a radical alteration of our existing laws, the aim being to safeguard the citizen from the torments inflicted on him by the processes and products of the new technology. The Age calls for a charter of amenity rights, and on moral grounds at least,

the case for such a charter is more powerful than that for the existing laws on property rights.

At all events, once such amenity legislation is accepted, the various proposals put forward by economists fall easily into place, or else become superfluous. Pollutant-creating industries will then have a choice of compensating claimants, of curbing outputs, of fitting anti-pollution devices, or of joining in comprehensive schemes involving the recycling of waste materials. The latter method of dealing with pollutants appears, at present, to be one of the most economic, and once the law provides the incentive to industrial research into new ways of dealing with pollutants, we can look forward to further development of such techniques.¹

Refugees from noise

A secondary and supplementary proposal which might be unnecessary once strong anti-disamenity laws became an essential part of our heritage, merits attention as an immediate and practical measure. The State alone is in a position to promote social welfare by taking the initiative in providing separate areas for those for whom quiet, clean air, and pleasant environment are highly valued. This can be done without prejudice to the interests of others who care less about them. Indeed, now that science has succeeded in launching humanity into the supersonic era, it is of the utmost urgency that governments everywhere be prevailed upon to set aside large areas free at least of aerial disturbance. The longer the delay the greater becomes the apparent dependence of the economy upon such flights; the more industrial operations become re-scheduled to new timetables, the further the process of integrating airline flights with other means of transport and the more massive the build-up of vested interests and expectations.

If reservations were set aside in the United States as a matter of justice for the American Indians who wanted no part of the society of the white man, a similar justice is surely due to the citizen who wishes to opt out of at least some of the features of technological society. For it is surely an injustice to compel noise-sensitive people to put up with arbitrary and continual noise-bombardment—though it is practically unavoidable in the absence of noise-free zones. Such zones are in any case

prerequisite to experiments in a variety of separate areas offering wider choice to the citizen in respect of environmental quality.

This proposal for amenity areas, free of aircraft noise, free of automobilisation and other sources of noise and fumes, yet viable and within commuting distances by rail to the main cities, is buttressed by other arguments.

What is the Good Life?

In a swiftly changing world, traditions have no time to take root. There is apt to be less agreement than hitherto on the constituents of the good life. It is altogether possible that many people are reconciled to the sedentary mechanised life offered by today's sprawling metropolis, along with the fumes, din, garbage, and tawdry façades. If so, it would be politically much simpler to encourage the creation of separate areas than to reach agreement among the public at large about the essential features of a more congenial civilisation.

Apart from political expediency, there is the humanitarian consideration. Many people today—call them frail, eccentric, hypersensitive, or neurotic, if you wish—find some aspects of modern society increasingly unbearable. For some it is the sense of isolation, for others it is the pressure of keeping up, for yet others it is the sense of futility and despair, or the incessant movement and the spreading wilderness of steel and concrete. Our affluent and technically sophisticated society at present offers them no escape—no alternative other than, perhaps, to wander off to the moors, or to the mountains, or to some Asian capital, there to die slowly of disease, drugs, and starvation; or else to feed on tranquillisers, or repeatedly to fall sick, or to attempt suicide or sabotage. A variety of separate and viable areas within which the seemingly persecutory features of the technological era are absent, and within which some redeeming features are incorporated, appears a feasible enough proposition whatever the state of the law. Moreover, it is an option that a rich country such as ours can afford and ought to offer to its citizens.

¹ In the United States, a number of economists have devised sophisticated mathematical programming models and in a number of cases have fitted estimates to them, in order to discover the minimum costs of meeting a variety of alternative water-purification targets in river basins.

Birds of Prey

by Robin Williams

Over the centuries, environmental change has led to the total or partial disappearance of many species which used at one time to be common in these Isles. While the last hundred years saw birds of prey persecuted blindly by gamekeeper and landowner in the name of sport, it is the years since the war that have seen the biggest changes. Although much of the automatic shooting and trapping of anything with a hooked beak has stopped and a considerable measure of legal protection has been afforded to birds of prey, their numbers have shown a most dramatic and frightening decline which still continues.

While the reasons for the decline are apparently obvious—concentrations of insecticides killing the adults or rendering the eggs infertile—it is as well to consider why the decline should be a matter of national concern. Is it something which should worry only those who delight in seeing these beautiful birds floating across the sky, or should there be more universal concern?

Although many people would argue that the question of aesthetics is important enough to be of universal concern, in fact birds of prey perform an invaluable job in keeping down the numbers of voles and mice, insects and other animals which would otherwise devour our crops. For this reason alone we should worry about their reduced numbers and the decline of species. Much has been said about the "Balance of Nature" and it has become fashionable to talk about its disturbance as soon as man broke the first sod but there is serious reason to believe that more thought ought to be given to this question before it is too late for the pattern to be changed.

The numbers of many animal species fluctuate according to the pattern and availability of food. In some years vole populations increase to near plague proportions which can cause complete stripping of grasses and cereal crops. When this happens, predators have extra large families and the pests are kept under reasonable control. Whatever the position with hunting and shooting, birds of prey have always managed to respond to increased food supplies by an increased rate of repro-

duction. In those heavily kept areas where, at the beginning of this century, birds of prey were wiped out, farming was often considered less important than sporting interests. Rodents would increase and the reduced crops were accepted. Even so, in most places a plague of mice would be met by predators coming in from outside the area.

With infertility induced by chemicals there can be no rapid increase of numbers to feed on the rodent plague. The "Balance of Nature" can be said to have truly failed at last.

To see how this state of affairs has arisen it is necessary to understand that birds of prey are at the end of a long chain of food links. DDT and other persistent insecticides are sprayed on to fruit and vegetable crops. Insects bite or suck the leaves and fruits and these insects are then killed in their millions. Some insects develop an immunity and can tolerate high percentages of persistent insecticides. These, and others that have only just ingested the poison, are in turn eaten by birds, which are in turn eaten by birds of prey, weasels, rats and other predators. If the insecticide is of the highly persistent variety, it becomes more concentrated in the

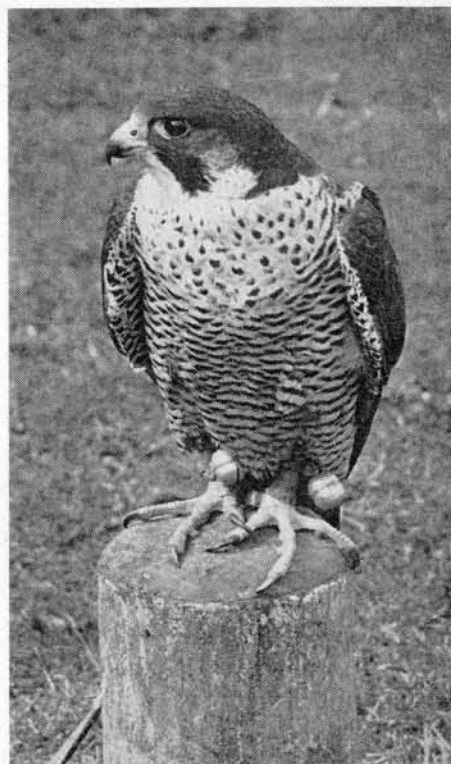
Robin Williams has been interested in birds and animals all his life. He was born in 1932 and spent his boyhood in Devon. He took a degree in agriculture at Cambridge and began his working life as a representative advising farmers on the use of crop sprays and fertilisers. Then he went for a time into the wine trade and from there to a firm of management consultants dealing in transport and distribution in industry. His interest in the countryside has not left him and his drawings of birds have appeared in magazines. He photographs and writes about wildlife and has his own collection of waterfowl. He is married, has three children, and lives now in Somerset.



Golden Eagle



Red Kite



Peregrine Falcon

organs of each host. At the end of the chain, birds of prey concentrate the poisons from many affected victims within their organs and tissues. Many of these birds are killed by the sheer toxic effects, while others are destroyed as a species by failing to set fertile eggs.

Another chemical which had disastrous effects on birds of prey was dieldrin, introduced to general farm use in the early fifties. Among other uses, this substance has considerable value as a seed-dressing to combat the serious menace of wheat-bulb fly in autumn sown cereals. It is most effective in controlling this pest but, applied as a universal seed-dressing, it has also killed pigeons, partridges and pheasants. Countless birds of many species were found dead near treated fields and the chain reaction extended through to the predators.

Mice eat grain, birds of prey eat mice; birds of prey either die or are found to be sterile. Some chemicals are sprayed where they can contaminate water sources such as lakes, ponds or ditches. Fish absorb many of the chlorinated hydro-carbons and concentrate them in their organs. The osprey and other species eat fish. In some parts of the world fish-eagles and ospreys are rapidly

declining in numbers.

Many cases are now recorded where the intended victim of the sprays has now developed a resistant strain which can tolerate double or triple strength insecticides—although their bodies are lethal to predators. It is a horrifying tale of our inability to foresee the full effect of our actions.

While not much is known about the bird life of Britain before the last few centuries, when observers started to write down their findings, fossils and bones from middens do give a picture of the conditions that must have pertained earlier in history. While many birds of prey have become all but extinct in Britain in the last century or so, previous major changes appear to have taken place in Saxon and early Norman times, when vultures, gyr-falcons and eagle owls were all to be found in this country. In present times, however, the first and last are natives of Europe and are rarely reported as visitors, while the gyr-falcon is a native of Iceland and the North American Tundra. In Norman times, many other species are also believed to have bred in the depths of the native woodlands. Goshawks were not uncommon and kites and buzzards soared over the hills. Now the goshawk is a

most rare visitor, reported to breed in a few hidden locations only.

Over the past hundred years further changes have taken place. In the Victorian age, egg-collecting became a consuming passion. Gamekeepers and landowners declared war on anything that was remotely likely to prey on game-birds. Collectors would shoot any rare bird with the object of displaying it in a cabinet. As a result certain birds no longer breed in Britain.

The osprey used to be common on lakes in England and Scotland but was finally hounded out by egg-collectors and shooters—one of the last pairs being shot at the nest in Loch Assynt in the mid 1800s by the famous sportsman, Charles St. John, who bewailed its passing in print afterwards. The white-tailed eagle, an enormous bird which frequents cliff and island haunts, was common in Scotland and extended into the Lake District and the Isle of Wight in the eighteenth century. By the early days of this century, it was persecuted out of existence in this country. The same fate was almost suffered by the golden eagle but its wider range inland and the remoteness of its haunts appears to have prevented its demise, together with the far-sighted protection afforded it by

certain estates in Scotland, notably the Duke of Sutherland in the 1890s.

Shooting, together with a change in our sanitary habits, has completely altered the status of the red kite over the past two hundred years. In the Middle Ages the kite was as common as black kites are today in Indian villages. They dealt with carrion, rubbish and dying animals which would otherwise have transmitted disease. Now there are but a dozen pairs left in the country, ultra-shy birds breeding in the remote, part-populated areas of mid-Wales, sailing away at the mere sight of Man. Carrion is no longer freely found in the countryside. This has undoubtedly had an effect, but we have been the main cause of their decimation through our relentless persecution of them as destroyers of game-chicks. I count myself most fortunate to have seen this bird on a recent visit to Wales and to have taken a picture of it hanging over a mountain edge, wide-fingered wings and forked tail spread to balance it in the wind, survivor of former multitudes.

Birds which in recent years were common, and are still popularly thought of in this way, are no longer to be seen by the casual watcher. Since the War, the sparrow-hawk, haunter of hedgerow and coppice and familiar from Shakespeare and other writers, has become so reduced in numbers as to become a rarity in many areas. It is virtually extinct in the eastern counties. Chemicals have achieved this, after years of persecution by gamekeepers had failed to make a major impression on their numbers.

The kestrel has suffered also. Where formerly one might have seen three or four of these pretty little falcons hovering over a field, now there are many places where they are never seen. Fortunately for the kestrel, it has a new man-made habitat in the verges of motorways, where large populations of mice and other rodents have built up. What effect the regular weed-spraying may have in the long-term is not yet known.

A different factor reduced the population of buzzards, which up to a decade ago were spreading out from the West Country, Wales and Scotland to cover a wider area. At this critical stage of their recovery from the persecution by earlier game-preservers, myxomatosis hit the rabbit population, which was their main food supply. It

was feared that these beautiful and majestic birds would be unable to survive, but in fact they adapted themselves to smaller prey and, after a reduction in numbers to about half, are slowly increasing.

Both tawny and barn owls have been affected by the use of chemicals, but only the barn owl seems to have been permanently reduced in numbers. In many areas this great white shadow, seen floating soundlessly over the fields at dusk, is now totally extinct. This is tragic by any standard. As a figure of beauty and majesty it will be missed. As a useful predator it was unmatched. Its diet is almost entirely confined to rodents, from rats to shrews. The tawny owl has also been reduced in numbers but for some reason not to the same extent.

While chemicals remain the major cause of the reduction in numbers of many species of birds of prey, there are other causes which can be shown to have direct effects. Drainage has slowly altered the character of our environment over the centuries; but we are now seeking out each soft spot and doing our best to drain it and use it for building or growing crops. Drainage of those odd corners, as well as major tracts of apparently useless marsh, can be financially attractive but it brings problems.

Wetlands form a major habitat for many species of birds including a number of birds of prey. Among these may be counted the various species of harrier: long-legged, broad-winged birds of lazy-seeming flight. Centuries ago they could be seen all over England. Now they are confined to East Anglia and a few carefully preserved pieces of Fen. In common with others they have suffered a recent drastic reduction in numbers but are unlikely to come back again as a common species because their habitat has been greatly reduced in extent. In this article it would take too long to discuss the effects of drainage on agriculture; it could be argued, for example, that the drainage of every last corner has led to many of our present flood troubles and water shortages. We could do with more marshes to act as natural sponges and regulate the flow of water to the countryside.

So far I have discussed the decline of birds of prey over the centuries and the accelerated problems of the past few years. What has been done to

help; and what more should be done?

First, the Royal Society for the Protection of Birds and other conservation bodies have brought the facts to the attention of public and Government. The worst offending chemicals, aldrin and dieldrin, are now only used on the land in certain specific cases where their apparent benefits are calculated to outweigh the remaining dangers to wild and other life. More stringent testing is now required for all chemicals used in agriculture, and greater insistence is being laid on the correct times of application. In this way it is hoped to avoid killing beneficial creatures like bees, while still controlling such pests as aphids at the critical stages of their attacks on crops. This still leaves dangers to forms of wildlife that feed off the creatures which eat these affected plants.

We still appear to be relying for future control of pests on chemicals applied to plants or soil, although the dangers of this can be seen in the build-up in the tissues in man of such substances as DDT while insects are everywhere developing immunity.

Elsewhere, biological control has been proved to work in overcoming specific diseases and pests. This would seem a more fruitful line to pursue for our future health and the preservation of wildlife than chemical controls with their unknown long-term effects.

Recent years have seen a growing interest in breeding animals in captivity for release in the wild. The best-known example of this is the work of the Wildfowl Trust, which has released Ne-Ne Geese in Hawaii where they were almost extinct.

Birds of prey are now also being catered for in this way. The pioneer was Mr. Philip Wayre of the Norfolk Wildlife Park, who bred eagle owls in captivity and released them in Sweden where they were threatened with a reduction in numbers. Another person who has long been interested in this aspect is Mr. Philip Glasier, Director of the Falconry Centre in Gloucestershire. His collection of birds of prey has a section devoted to breeding for later release. Visitors to the Centre became interested in this project and eventually a charitable trust was formed to promote these views.

The Hawk Trust has recently produced its first Annual Report. Among the articles covering conservation, the diseases of hawks and the rearing of

the first broods of young kestrels to be released under the Trust's auspices, is a set of the Rules, demonstrating the aims of the Trust. Its object is to promote the study and conservation of birds of prey. It hopes to achieve this by way of breeding and releasing birds of prey, conducting research into diseases and ailments affecting them and publishing information on these and other matters as they arise. Strictly, its objects are worldwide, but initial work is being carried out on British species. It is hoped to breed in the future from red kites and buzzards as well as peregrine falcons, a pair of which has already been donated.

For many in the Trust, the peregrine represents the supreme challenge. While never common, they have bred round most of our coasts since time immemorial, and it is generally conceded that there is no finer sight than a peregrine on the wing. Chemicals have hit them really hard. A recent most carefully conducted count indicated that there were only 70 breeding pairs of peregrines in England and Wales, compared with ten times that number ten years ago.

For those willing to help in this worthwhile work the address is The Hawk Trust, c/o The Falconry Centre, Newent, Gloucestershire.

Nature has also taken a turn to help in some cases. Snowy owls, with five foot wingspan, hatched their first recorded brood in Britain in 1967 and have continued to breed in Shetland ever since. Ospreys have come back to Scotland and now breed regularly in the Cairngorms under strict protection by the R.S.P.B. Special arrangements have been made and they are seen by thousands of visitors under carefully controlled conditions, thus bringing pleasure to these people, and a boost to the tourist income of the region. Perhaps this idea could be extended to other birds in other parts of the country?

Conservation Year, 1970, has brought many of our vague feelings about the state of the environment into the open. Let us hope that the various Governments whose official consciences have been pricked do not let it all slip back into obscurity once the spotlight is off. Animals of all sorts contribute greatly to our enjoyment of life and many, like the birds of prey, also make a major contribution to our economy. Their presence matters to us.



Above: Eagle Owl



Above: Young Tawny Owl Below: Goshawk





by John Noble and
Harry Rothman

In September last year the corpses of over 8,000 sea birds were washed up on our coasts from Northern Ireland, Ayrshire, Cumberland, Lancashire to North Wales. We may never fully understand how this disaster came about for only eight of the dead birds were properly examined for toxic chemicals etc. However, they all contained larger than usual amounts of one particular compound, polychlorinated biphenyl or PCB. To most naturalists the name PCB meant nothing. For this reason we feel that it is worthwhile summarising the current state of knowledge of environmental pollution by PCB.

PCB is not a single compound but a general name for a whole family of compounds with a common basic structure. Mixtures of PCB compounds have interesting properties enabling them to be used in diverse technical areas. Our awareness of the ecological implications of PCB is comparatively recent and so it comes as a surprise to many people that commercial manufacture of PCB was begun as far back as 1929 by the Monsanto Chemical Company of America.

It was noted recently that the effects of exposure to PCB are not limited only to the immediate location of its use.

Since then PCB production has spread to most major industrial countries, including Britain. Monsanto are still the major manufacturer here and market PCB mixtures under the trade name Arochlor.

PCB is made by adding chlorine to biphenyls, terphenyls and other more complex poly-phenyls. Chlorination is done in special cylindrical steel towers three feet in diameter and eighteen feet high using special catalysts and heat.

The technical uses of PCB depend on their great chemical stability and special physical properties, which may be varied to suit specific applications. PCB has a number of uses in the electrical industry, in paints and varnishes where they have a similar role to oil except that they do not oxidise and lose their flexibility with age. Resinous products of PCB are an integral part of synthetic adhesives. Lubricants for use under extreme conditions often contain PCB.

The national and international production figures for PCB have never been published but we can see from the list of its applications that PCB is used on a large scale.

For such a widely used compound, toxicological data were pretty sparse, yet it was noticed recently that the effects of exposure to PCB are not limited only to the immediate location of its use.

Affects skin and liver

In the standard text on industrial toxicology, *Dangerous properties of industrial chemicals* by Sax, PCB is re-

ported to "have two distinct actions on the body, namely a skin effect and a toxic action on the liver. The lesion produced in the liver is an acute yellow atrophy... The higher the chlorine content of the diphenyl (=biphenyl) compound, the more toxic it is liable to be... The skin lesion is known as chlorache, and consists of small pimples and dark pigmentation of the exposed areas initially. Later comedones and pustules develop. In persons who have suffered from systemic intoxication the usual signs and symptoms are nausea, vomiting and loss of weight, jaundice, edema and abdominal pain. Where the liver damage is severe the patient may pass into a coma and die. PCB is also recognised as a disaster hazard, for highly toxic fumes are given off when it is heated to decomposition. Of course these are acute effects resulting from exposure to very high concentrations. Such a danger could only arise in the event of an industrial accident."

A very disturbing finding about the biological effects of PCB is that they can have an insidious effect on the hormonal system of birds. Hormones are vital in co-ordinating the complex biochemical reactions of living organisms. Any interference with the normal body-regulating effects of hormones could have a profound effect on an organism, for they control rates of growth, ultimate body size and shape, masculinity or femininity, mental and physical alertness.

Effect on birds

The way in which PCB interferes with the hormonal systems of birds, is complex and not yet fully understood. Only a small quantity of PCB can speed up the production of certain enzymes produced by small bodies in the liver, a process called enzyme induction. As a result, the calcium metabolism so vital in egg production, is disturbed.

This information becomes crucial when it is realised that PCB has been found throughout much of the global environment, even in measurable amounts (0.06 parts per million) in mother's milk samples in California. Environmental scientists are becoming increasingly concerned about any chemicals which can persist in the environment and be accumulated along food chains. How do they get into the environment and what long term toxic hazard do they present even in very

PCB has been found throughout much of the global environment, even in measurable amounts in mother's milk samples in California.

minute doses? In many ways PCB resembles DDT and related organochlorine insecticides. They are both fat-soluble, persistent and able to induce liver microsomal enzymes. They are fairly close chemical relatives and their ecological properties are literally interwoven.

History of PCB pollution

The tragic post-war decline of certain species of birds of prey and sea birds in many parts of the world is now well known. The story of the discovery of PCB pollution is intimately related to the unravelling of the mystery of this decline.

In the late 1950s, Derek Ratcliffe of the Nature Conservancy sounded the first warnings about the mysterious decline of the British peregrine population. When other birds of prey were similarly studied it was found that the golden eagle was declining in Western Scotland. Much circumstantial evidence pointed to organochlorine insecticide residues as the guilty agent and appropriate changes in the use of these compounds prevented a complete disaster. Ratcliffe also noted behavioural changes in the peregrine, birds eating their eggs, increased incidence of broken eggs. He also showed that the thickness of egg shells had decreased during the period since the introduction of organochlorine insecticides. This was the first evidence that the resulting widespread change in the chemical environment had in some way affected the calcium metabolism of the birds.

These events initiated routine analyses of wild-life cadavers in Britain. It was during these analyses for organochlorine pesticide residues that several workers noticed the presence of strange organochlorine compounds which they could not identify. These unidentified compounds were so similar to DDT etc., that they actually interfered with DDT measurements causing a certain amount of confusion. The unknown compounds occurred most frequently and in the largest proportions in the

livers, fat and eggs of birds, particularly terrestrial predators such as sparrow hawks and kestrels, and in marine feeders like guillemots and kittiwakes. They were also found in fresh water fish. Small amounts were detected in human fat samples, though in much smaller proportions than in the birds. In 1966 workers in Scotland found the same compounds in fish and seals in Scottish waters, the levels were low in the fish, whereas in the seals they corresponded to the larger levels found in birds.

The solution to the mystery of the identity of the compounds was provided by a Swedish scientist, Soren Jensen. At the end of 1966, the *New Scientist* reported that Jensen had found PCB in pike, and also in the hair

of his whole family, including a five month old baby. Jensen looked for PCB in eagle feathers in a museum and only found it in specimens caught after 1944. This is probably indicative of how long PCB has been an environmental contaminant. A little later, the British workers, Holmes, Simmons and Tatton, announced that the previously unidentified compounds associated with analyses for organochlorine insecticides were PCB. Their findings were repeated in the Netherlands and North America and soon PCB was found to be distributed throughout living creatures in the Northern Hemisphere.

More PCB in industrial areas

Riseborough and his American col-

Monsanto takes a big step

The chemicals implicated in the massive slaughter of seabirds off the north-west coast last autumn may soon be the subject of a voluntary ban.

Monsanto Chemicals, one of the principal manufacturers of the industrial chemicals polychlorinated biphenyls—known as PCBs—is trying to get other manufacturers to limit the application of the product. Monsanto want PCBs to be confined to closed-system uses, like its application in electrical insulations. This would mean a ban on the use of PCBs in paints and varnishes and coatings.

It is this second type of usage that causes the pollution. Factory waste pipes leak PCBs while manufacturing or using paints and surface coatings. The chemicals are carried in effluent into the sea where it is believed that unusual weather conditions can cause local concentrations. The amount of PCBs in these concentrations is still very low, but it can be lethal.

Without a doubt the source

of the pollution does not exist in the PCB manufacture stage. The only place in Britain where PCBs are produced—under the market name of Arachlor 1254—is at Monsanto's Newport, Monmouthshire plant. But the production process is dry and no PCB waste goes down the plant's pipeline into the Bristol Channel.

Monsanto will have to work hard to get co-operation, if only because rival manufacturers are of different nationality. But the value of a voluntary ban is highlighted by the recent disclosure of the Government Chemist. In his annual report, he reveals that the highest ever concentration of PCBs has been found in wildlife by his laboratory. The Chemist gives the results of an analysis of PCB levels in herons. Levels more than twice the previously recorded "highs" in seabirds were found. This is very disturbing, given the effects of PCBs on calcium metabolism.

Jeremy Bugler

PCB possesses great chemical stability and is therefore highly persistent once it escapes into the environment. It is likely that a steady build-up is occurring.

leagues have reported that the highest levels of PCB are found in wild life from industrialised areas. In the few land birds and fresh water species examined by American scientists PCB was found, and it is quite likely that the compound is now distributed in the continental ecosystems of the United States.

Exactly how PCB gets into wild life is not yet known, for unlike organochlorine insecticides, PCB is not deliberately sprayed into ecosystems. There are however several possibilities. The fact that PCB residues are generally highest in creatures living near to industrial areas, leads us to suspect that PCB might escape from the factories manufacturing or using it. It could be released in effluent or PCB-containing hydraulic oils into the rivers, eventually reaching the sea. Another potential PCB source is air pollution. It has been suggested that transport by air currents explains the presence of PCB in remote regions like Alaska. As far as we know no one has recorded and measured the presence of PCB in the air. It might escape into the atmosphere during its manufacture at a point when high temperatures are reached. Alternatively, the burning of waste containing PCB may lead to atmos-

pheric pollution. The Ministry of Housing and Local Government has started a research project to examine the sources of PCB pollution which will no doubt throw more light on this problem.

Long term effects?

PCB possesses great chemical stability and is therefore highly persistent once it escapes into the environment. It is likely that a steady build-up is occurring. Small amounts of PCB have been shown experimentally to have sublethal physiological effects on birds, and small amounts are now found in people. Will they have any long term toxic effect? Nobody knows, but do we have to wait? The best move might be to suspend further use of PCB in industrial processes until one has established its effects on ecosystems and human health. Such firm action would also act as a spur to industry to work more seriously in the future on the ecological implications of their action.

The almost accidental manner in which PCB pollution was discovered does not give us great confidence in the present environmental monitoring effort. Wildlife populations are as someone once said "our miner's canary", but only very rarely is there the necessary information about population dynamics to say with any accuracy whether a particular population is behaving in a peculiar fashion. It is necessary to finance, on a world scale, studies of a carefully selected range of species so that we can biologically monitor environmental changes. Any change in the numbers, behaviour or chemical composition of an indicator population would be noted and its cause searched for. It is a priority task, and the scale of activity in such monitoring ought at least to be tied to the increasing rate of industrial activity. The cost of such a "doomwatch" activity may be high, but if it helps mankind to avoid large scale ecological disasters, it is a price that has to be paid.

SYSTEMATICS

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History, Philosophy and the Sciences

Editors J. G. BENNETT and KARL S. SCHAFER

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MIND AND MATTER

J. G. Bennett

THE AMBIGUITY OF 'ONE' AND 'TWO' IN
THE DESCRIPTION OF YOUNG'S EXPERIMENT

H. Bortoft

WILL TYPE INVESTIGATION

G. H. Edwards

IDEA DEVELOPMENT AND ADVANCEMENT IN
ENGINEERING

E. Matchett

Harry Rothman, aged 32, is a graduate in Zoology, and has a deep interest in ecology and its political implications. He lectures in the Department of Liberal Studies in Science, Manchester University on the social relations of science and technology. In 1971 his book on Industrial Society and Pollution will be published by Hart-Davis in UK and Bobbs-Merill in USA.

John Noble, aged 22, graduated from the Liberal Studies in Science Department last year (1970). There he read "Science Greats" an honours course designed to develop "scientific generalists".

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student action

What can be done

The trouble with exposing the implications of short term thinking and with attacking the careless application of technology is that it is difficult to convince the reader without inducing in him a feeling of hopelessness. "That is all very well", he will reply, after you have bludgeoned him with the contamination of air, land and water, and the dissipation of non-renewable resources, "but what can I do about it?"

It goes without saying that the individual can do a lot, once he has shrugged off the apathy which is so much a part of our cumbersome democracy. He can join one or more of the voluntary bodies listed in the December issue of *The Ecologist*. He can write to his MP and pester Government Departments (such activities carry weight though it may not appear so at the time.) If he is a student he can help mobilise the vast ill-organised discontent of his fellows into effective political action.

This action can range from cleaning up local black spots to encouraging local authorities and local industry to greater environmental responsibility—and finally to persuading our elected servants that they should concentrate more on social and environmental amenity and less on the persistently elusive short term economic gains used as excuses for the continued disruption of the environment.

At the moment a vote is not so much a wasted vote as a vote for pollution and waste. Now that the voting age has been lowered to eighteen all students everywhere have the perfect opportunity for really effective "ecology action". They have only themselves to blame if they ignore it. *The Ecologist* is keen to give whatever help it can to any University or College society with conservation or the broader environmental issues as its main aim. As from this issue *The Ecologist* will

be available at a special student price of 3/- a copy (subscriptions £2 per year) while student societies may sell copies on our behalf at a price to them of 2/- on sale or return. This column will be available exclusively to students for the exchange of news on environmental activities and for ideas for making action more effective. The rest of the magazine of course is open for debate about more general issues. For the moment here is news of two groups which have been set up recently.

Campus Information

Cambridge University. The responsibility for publicising the need for sound environmental management is accepted by the Cambridge Society for Social Responsibility in Science (as indeed it is by local branches of that organisation in many other Universities and Colleges). This society recently established an Ecology Action Group which is involved in discussion and analysis of population pressures, as well as in monitoring traffic in the Cambridge area.

There is also an extremely active branch of the Conservation Corps, which has worked for the practical improvement of the environment. Since its inception ten years ago, the Cambridge branch has played an important part in the management of the Cambridgeshire and Isle of Ely region. It works in close co-operation with the Isle of Ely Naturalist Trust which meets its expenses, and also sends volunteers to assist in London Conservation Corps projects. The sort of work it performs varies from path clearance and bridge construction to ragwort-pulling and coppice maintenance, and the number of man hours devoted to such tasks is impressive. In the first two terms of last academic year students gave up a total of some 1,500 hours to take part in conservation work.

Francis Arnold at Churchill College is the man to contact for more informa-

tion on the Ecology Action front, and John Booth of Pembroke is the coordinator for the Cambridge Conservation Corps.

Farnborough Technical College. In European Conservation Year, Mrs. Jo Hooley, lecturer in the Department of General Studies, thought it appropriate for the students at Farnborough to examine local pollution problems. This they did, and in a magazine called *Nothing but Smut*, the students (first year OND Engineers) complained of the state of the oil-laden Cove Brook, derelict buildings and the Basingstoke Canal, which they claimed contributed a considerable hazard to health. The project received good coverage in the *Surrey and Hants News*, the local paper, where they received support in an editorial which declared: "In Farnborough the students have given a lead... Let's join them and make European Conservation Year something more than just another fancy title. Let's hope for action on a local level to clean up our black spots. And is it asking too much for a strong lead from the local Councils?"

The extent of local apathy was amply illustrated by a survey which concluded that local people simply did not care what sort of mess their environment was in. But one outcome of the students' protests was that a representative of the Thames Conservancy Board visited the Cove Brook to examine the extent of oil pollution. Dredging was subsequently brought forward from Christmas to August 1970.

What of that "strong lead" expected from the local council? Don't worry, recently Farnborough Council issued a statement—warning children that the mortar bombs presently being revealed by the falling water level in the Canal might be dangerous.

I understand that next year the first year OND Engineers will be considered adult enough to vote.

Graham Searle

OPEN CAST

CLEAN UP

by Robert Allen



Over the last five years the National Coal Board's Opencast Executive have restored some 800 acres of derelict land a year. Not a lot perhaps, but it's a good start, and the Executive has deservedly won the Prince of Wales' 1970 Countryside Award. Whether or not such restoration is 'beyond the call of duty' as the citation has it depends on one's idea of industrial responsibility, but at least something is being done, as these before-and-after pictures demonstrate.

Photographs by courtesy of the Opencast Executive

Cottage Hall

Left. Before (1964). Part of the spoil heap of the Caer Bryn Colliery, which closed in 1926. The Opencast Executive began mining in 1965, extracting 670,000 tons of anthracite up to 1969.

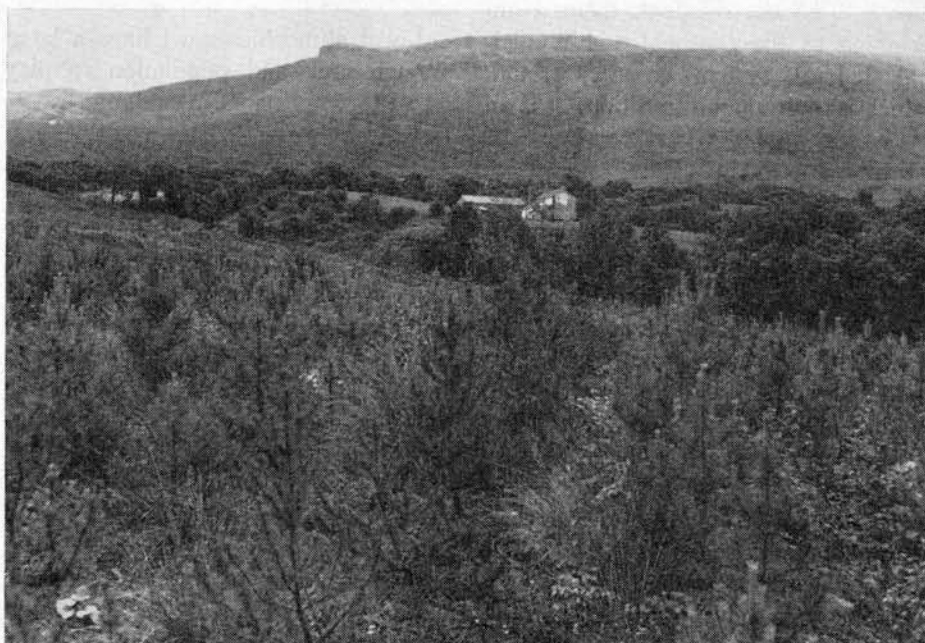
Right. After (1970). Shale from the tip has been used as filling and covered with soil provided by the Ministry of Agriculture's Land Services Division, which also seeded it with grass and will now plant hedges and trees.



Empire Site, Dunraven Deep

Left. Before (1963). Formerly given over to forestry and grazing, this site was only partially derelict. 2,700,000 tons of anthracite were produced since mining began in 1957.

Right. After (1970). Now the land is being restored to forestry.



Saron Tip

Left. Before (1968).

Right. After (1969). This is perhaps the most interesting pair of pictures. The Opencast Executive and the Derelict Land Unit of the Welsh Office were approached by Llandeilo R.D.C. to help them remove the tip. As can be seen, the result of the removal has been the spontaneous repainting of the houses nearby, and the occupier of the house in the foreground has even replaced his corrugated-iron shed. These pictures show how people respond to a pleasant environment—once they are given the chance.



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Europeans talk local government

Three thousand delegates from local authorities throughout Europe met in London last summer for the 9th Assembly of European Municipalities. A major area of discussion was the development of local government within the context of a united Europe.

They heard Dr. Henry Cravatte, one time Deputy Prime Minister of Luxembourg, say in his opening address: "Are there not already, in some European countries, examples of organisation and operation which could be converted to the European scale? I do not necessarily mean the German and Austrian Federal Republics, though of course I do not overlook them. I am thinking of the cantonal and municipal federal system in Switzerland, which is more than a tradition: it is an institution, and the very cause of the existence of this country from which we could draw valuable lessons. Federalism, regionalisation and municipal self-government are the conditions for a genuine democratic participation in the management of public interests, the condition for a friendly coexistence between people who differ in language, culture and faith, a compensation for the concentration of economic powers, the widening scope of administration and the power of technocracy, an effective counterweight to the nationalism of the major States."

After three days of discussion the delegates put out a Final Declaration which stated that since a major aim of the new European society must be to ensure an equal chance of prosperity for all its peoples the present regional inequalities throughout Europe were intolerable.

They considered that a straightforward customs union and development based solely on free trade would maintain and aggravate those inequalities.

They hammered home their belief that regional inequalities, economic difficulties and the many increasingly critical ecological problems could no longer be solved at national level. They called for an overall general policy under the responsibility of the European Economic Community which should be given financial resources to do the job and the power to decide priorities.

The Conference believed that the establishment of a European community was an essential condition for promoting balanced regional development but it stressed that it must be based on the effective participation of local authorities at all levels.

Local government would have to develop along convergent lines everywhere so that the final result would be comparable administrative structures in all countries.

Within a unified European Community, said the Conference, the powers of local authorities should be greater than in the existing national states. As national governments progressively relinquish sovereignty and administrative powers to the Community, it would be more and more necessary to strengthen and develop local and regional autonomy.

Local authorities must have a large enough area and population to play an effective part in administrative tasks.

The Declaration maintained that the member states of the Community, both small and great, would have to be divided into regions of adequate size with their own administration, powers and financial resources and an assembly elected by the people, with powers to take all decisions relating to economic development and town and country planning.

These regions would form the intermediate level of administration between the central government and local authorities and would therefore still be close to the citizens. Their size would vary according to the situation of the various countries, their historical development and the needs of their population.

David Evans

The Baltic

It is common knowledge that the Baltic Sea is rapidly becoming a biological desert, robbed of its life by man's incredible thoughtlessness. But it is not generally understood why the Baltic should be especially vulnerable to damage by polluting agents, more dramatically, that is, than other sea masses.

The point is essentially one of topography. The Baltic is not so much an open sea as a very large fjord, with only very narrow and shallow entrances through the Danish sounds and the Oresund. It is almost entirely closed in. Hence, if the peripheral countries treat

their sea as a huge communal dustbin, there is very little chance of the rubbish being carried away and dispersed into the North Sea. The industrial wastes and sewage carelessly dumped without any prior treatment into the Baltic Sea are doomed for the most part to remain there.

Even that would not matter very much, but the pollutants which we consign to the deep have a habit of coming back to us in different guises. The depths of the Baltic use so much oxygen in their breaking down of organic wastes, that there is precious little left to support marine life. And that which does survive, and which finds its way to our dinner-table, has absorbed so much DDT and other toxic substances as to be positively dangerous.

There are two kinds of pollution in the Baltic, producing two different results. First, there is pollution by oxygen-demanding substances; secondly, pollution by toxic substances.

Sewage from towns and industrial wastes both contain organic and other materials in solution; when carried out and broken down in the sea, they take oxygen from the water. In this direct way, the oxygen content of the sea is being depleted, with obvious consequences for life.

Those wastes containing phosphorous have an indirect, but equally devastating effect upon the oxygen supply. Phosphorous stimulates the generation of living organisms in the surface layers of the sea. This then adds to the load of sinking organic matter which is broken down in the lower layers, at the cost of yet more oxygen.

The phosphorous concentration in the Baltic is on the whole lower than in, say, the North Sea. But even a small concentration is far more dangerous in the Baltic than in the North Sea, due to the special topographical conditions which trap everything in the Baltic, and to the abnormal situation affecting oxygen supply. It is estimated that up to 20,000 tons of phosphorous are deposited in the Baltic annually.

Under regular conditions, oxygen should filter down from the upper layers of the sea to renew the supply in the depths. But in the Baltic the process of vertical exchange of waters is hindered.

Between the low salinity surface waters from rivers discharging fresh water into the sea and the deeper more saline layers there is a permanent halo-

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cline which then prevents the vertical exchange of waters. During recent decades, there has been an increase in the salinity of the bottom layers, thus strengthening the effect of the halocline.

In addition, there is, during the summer months, a thermocline formed by the heating up of the surface layers which are then warmer than the lower layers. This, too, conspires to hinder the vertical exchange of waters which is necessary to the supply of oxygen in the depths.

Given special circumstances prevailing in the Baltic, it is nothing short of sheer madness to discharge into the sea vast quantities of organic waste matter which must then be broken down by the ever-diminishing supplies of oxygen. At the present rate, there will soon arise a situation in which the Baltic is no longer able to support marine life. In some areas, fishery has already become impossible.

So much for pollution by oxygen-demanding substances. In addition, there are hundreds of substances known to be toxic for marine life which are discharged into the Baltic from sewage and industrial wastes. Many of them are taken up by organisms which tend to accumulate them, and when certain threshold levels are reached, they become dangerous. Predators eating contaminated preys may in this way absorb high concentrations, and via fish, for example, toxic substances may reach man.

It is well known that DDT is found in organisms over the entire world, even in areas where it is not used. This dispersal has, on the whole, occurred since World War II, that is during about only 25 years. Swedish investigations have shown that polychlorinated biphenyls (PCB) deriving from certain industries and contained in many ship-paints, have similar toxic effects and are, alarmingly, even more persistent than DDT (Jansen 1968).

A recent study has shown that certain fishes and fish-eating seals and seabirds from the Baltic may have concentrations of ten times or more of these toxic substances than corresponding animals from the Swedish west coast. (Jense, Johnels, Olsson & Otterlind 1969.)

The high accumulation of DDT and

PCB in the Baltic is due, once again, to the restricted water exchange between the Baltic and the sea area outside, causing an abnormally long residence time for the Baltic water. An ICES report published this year calculated the average residence time to be about 20 years.

A further disturbing consequence of toxic pollution lies in its ability to upset the learning ability of fish. Salmon, for example, migrate from the sea to their home rivers by using their organs of smell and memory. These are adversely affected by DDT. If the DDT level in the Baltic is allowed to continue to rise, we may expect total confusion in the migratory habits of fish. It has already been demonstrated (Anderson & Prins 1969) that trout have been influenced in this way.

Mercury compounds provide yet another dangerous pollutant. High mercury contents have been found in fish in some coastal areas, and some parts of the Swedish coast have been declared prohibited fishing areas.

Oil pollution may yet compound the disaster already produced by pollutants described above. Underwater prospecting for oil will be started in the southern Baltic in the near future. If oil is found, it is clearly essential that every kind of precaution be taken to prevent the kind of accident which recently occurred at Santa Barbara. For an enclosed sea area like the Baltic, such an accident would be nothing short of catastrophic.

Fortunately, the Baltic countries are aware of the dangers, and have been co-operating, mostly on a bi-lateral basis, to control the situation. But the signs are that it is still worsening. Until man takes full responsibility for his progressive contamination of the Baltic Sea, there will remain the frightening possibility of total stagnation. Man will be at fault, and man, in the end, will suffer.

Bernt Dybern

The revolution to come

There was very little talk of "doom" at Attingham Park in October, where the Soil Association met for its annual conference. Members had been presented with gloomy predictions and dire warnings for long enough. Now they were anxious to seek solutions.

Discussions kept returning to population control: its practicability, not its desirability. Gerald Leach, science correspondent of *The Observer*, suggested

ways in which, without legislating, governments might create subtle pressures that would reduce birth rates. If it were made much easier for women to enter universities and colleges of further education, for example, and if they were actively encouraged to do so and to follow careers, the start of their reproductive life would be postponed. Several speakers were in favour of easier abortion, but Mr A. Elliot-Smith, formerly senior surgeon at the Radcliffe Hospital, Oxford, warned of the universal opposition to abortion in the medical and nursing professions. Since his retirement he has established and now runs a clinic for male sterilisation. He said he had been surprised at the demand for vasectomies: the clinic has a long waiting list. He and his colleagues have been able to identify the ideal candidate for this operation: the man in his mid-thirties with a stable marriage and as many children as he and his wife wish to have. The operation is simple, perfectly safe, and quick. The patient is in the clinic for only an hour and is absent from work for only two or three days. At the present time there are very few such clinics in this country and Mr Elliot-Smith urged that they be brought under the National Health Service and expanded. Surgeons are generally employed to their full capacity, so that additional work can be undertaken only at the expense of other operations, but retired surgeons might wish to devote their time to work that is not over-taxing and which is of vital importance.

The need for population control is urgent. The larger the population, the greater the need for manufactured goods to maintain the general material standard of living. Whether or not this is desirable is irrelevant: it is impossible. Our present affluence is based on our consumption of non-renewable resources and increases in our standard of living reflect no more than an increase in our rate of consumption.

John Davy, the scientific journalist who left the staff of *The Observer* in order to teach, spoke of the seductiveness of technology. Technologists, he said, are like children with new toys that fascinate them. This is particularly evident in Europe among those working on the Concorde project, and he quoted Robert Oppenheimer who, when asked why the Manhattan Project was allowed to proceed once the scientists knew its implications, replied, "It was technic-

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ally sweet". There are times, said Mr Davy, when the toys must be taken from the children lest they hurt themselves or others. We must be cruel to be kind.

Professor Conrad Istock, of Rochester University, New York, challenged an assumption by some economists that the ecological effects of economic development cannot be assessed. This is no longer so, he said. Ecologists can assess very accurately what these effects are likely to be. He illustrated this with a brief and lucid account of energy budgets. Any ecosystem can be evaluated in terms of the energy it uses. Incoming solar radiation produces photosynthetic chemical reactions in green plants and this in turn provides the chemical energy to power the remainder of the system. This can all be measured and in his view the availability and utilisation of energy within ecosystems should be given as much consideration as economic budgets. He warned of the danger of depleting one of nature's most basic resources: the variety of wild plants. Agriculture has proceeded from the selection and sub-

sequent selective breeding of particular plants which have a food value. If these decline, we reduce the possibility of selecting new food plants in the future.

The resource most immediately threatened, however, is fuel. Peter Bunyard talked of the limited availability of sources of energy, a subject that has also engaged the attention of Dr Hugh Nicol, a chemist who worked for many years at the Rothamsted agricultural research station. Our pollution problems can be traced to the consumption of fossil fuels, he claimed, and suggested that the definition of an ecosystem be extended to include what is below ground level. Pollution is a symptom, not the disease, but Gerald Leach mentioned one novel piece of reformist legislation. He suggested that factories be allowed to abstract water only downstream from the point at which they discharge effluent.

The race towards ever-greater production from ever-larger units has affected small businesses generally, but it has had a profound social effect among rural communities. Edward Goldsmith, editor of *The Ecologist*, said the decline of Rome might date from the decline of its small farmers. Mary French, author of *The Worm in the Wheat*, gave a moving description of

the effect of farming economics on the small farmers among whom she grew up.

Faced with the need to reduce consumption, to recycle materials and to prevent the further degradation of the environment, action by the individual is vital. Already there are people, many young people in particular, who realise this and who are modifying their own lives. The conference was told about this movement and of the attitudes and ideas of those involved in it. If it should succeed, we may be witnessing the beginning of a new culture, in a society which seeks stability. "The stationary state," said Dr Nicol, "is a truly scientific concept." Speaker after speaker reached the same conclusion and Edward Goldsmith devoted the whole of his talk to the nature of this stability and the forms it might take.

This year the conference touched the very centre of the environmental crisis, not in order to identify it, but to solve it. Perhaps the quiet Shropshire countryside that once resounded with the clamour of the ironworks which marked the beginning of the industrial revolution, may have heard the quiet murmur that announced the revolution that is to come.

Michael Allaby

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Down to Earth



by Lawrence D. Hills

Conquering carrot fly

The carrot growers of Cambridgeshire are chased from field to field by greenish black, fifth inch long, flies. For the only way of beating the new aldrin-immune carrot fly is to rent a field for a single season, grow one crop and move to another twenty acres or so of good and light land eight or ten miles away.

When the tiny, creamy, chrysalids hatch, the flies radiate in all directions in quest of carrots, keeping low along the headlands out of the wind and sun and fuelling themselves on the nectar and pollen of cow parsley. If they pick up the scent of crushed carrot foliage from thinning in late May or early June, they can "home" on it like a radio beam from as far as seven miles.

The lucky flies which started in the right direction and picked up the beam on a friendly wind, will taxi along the rows and lay their eggs under the sheltering carrot foliage near the field edges. These hatch into tiny colourless maggots which dive straight down through the soil before attacking the root tip of a young carrot and boring up inside it. When they are fully fed they crawl about five inches away from the sheltering root, whose familiar reddened foliage tells the gardener of underground disaster, and pupate, hatching in July, August or September.

This generation has no long flight along the hedgerows, though the later flowering hemlock and wild carrot can fuel them on their way from a field where an early variety has been grown and cleared. All they usually have to do is use their eyes and fly further and further into the crop, laying the eggs for next year's flies.

It would be impossible to grow our highly scented red carrots without the natural controllers that once balanced the fly when it lived in the roots of the wild species.

Two smaller flies, *Dacnusa gracilis* and *Loxotropa tritoma*, follow the migrating carrot flies (*Psila rosea*) like fast fighters after heavy bombers. Both lay

their eggs just under the soil near the carrot fly's clutch and their maggots overtake those of the carrot fly before they reach the safety of the root tip, and parasitise them, so that they must eat for two. As a result the pupae hatch into *Dacnusa* or *Loxotropa* instead of carrot flies. Between them they can destroy up to 70 per cent of the first hatch, which is why the second wave of carrot fly attack is rarely so bad, though in theory it should be far worse. A second generation of *Dacnusa* can destroy up to 20 per cent of even this late hatch.

These two cunning flies bury their eggs and avoid the danger carrot fly eggs face from the nimble ground beetles of which *Bembidion lampros* is greediest. One captive specimen ate 428 eggs of the related cabbage root fly in six months, and 16 eggs a day is an average for these busy hunters along the carrot rows. The larger violet ground beetle, *Carabus violaceus*, is also an egg eater and with the familiar devils-coach-horse, *Staphylinus olens*, eats great quantities of pupae in winter.

The popular chemical control method was to spray the hedgerows with DDT or other persistent pesticides to make the cow parsley poisonous to all visitors including bees. Then the resistant carrot fly strain appeared, but unfortunately no DDT-proof *Dacnusa* or *Loxotropa*, so these were destroyed with a host of assorted insect life. So the immune carrot flies flew safely on, and without the loss from parasitised larvae produced a second generation attack more than three times as bad as the first.

Aldrin, dieldrin and now BHC usually with an organo-mercury compound as a seed dressing are now used to taint the area round the carrots and kill the maggots on the way down, but unfortunately they kill the *Bembidions* and other beetles as well, so any maggots that escape have a clear run without any enemies, multiplying by millions in a very few generations. However deadly the poison, we cannot kill all the carrot flies, with an inexhaustible reserve in every hedge and wasteland, ready to move in to perfect conditions for a population explosion, if we destroy their natural enemies.

On a garden scale remedies range from digging over the carrot bed two or three times in winter to give the expert eyes of the local robin a chance to see and peck up the pupae, to many

attempts at jamming the scent message. Planting onion sets between the rows, spreading paraffin soaked sand or sprinkling lawn mowings on the bed, even stretching creosoted string round it, are all effective up to a point, baffling distant flies but failing at close range with a powerful "signal".

In 1965, the Henry Doubleday Research Association began experiments with a range of scent attractants mixed in brown sugar and water, in jam jar traps covered with expanded metal to exclude bees. The winners were all from members of the order *Umbelliferae* (the carrot and cow parsley tribe) with coriander oil the most effective. Though large numbers of flies were caught with this imitation food scent, especially cabbage root flies, however effective the trap may be, it cannot beat the illegal immigrants from the hemlock in the hedgerow.

Fifteen years ago Mr P. Ord of Aldeburgh, one of the Members, had the idea that carrot flies taxi along the rows to see if the carrot tops show a root likely to be thick enough to offer safety to the maggot at the end of its dive. So he "earthed up" his carrot rows like tiny potato ridges and has had no carrot fly trouble ever since. In 1970 a team of Members tried it with the same result and established also that if anything, covering the growing points and about two inches of leaf stalks, produced an increase of yield.

Now the 1971 team may include a hundred gardeners, many working in places where the build-up of carrot fly in allotments and institutions has made it almost impossible to grow the crop. Their experience should justify a machinery manufacturer developing tiny potato ridging bodies to fit on a tool bar and ridge twenty rows at once at tractor speed. There would probably be enough extra yield to pay for the labour and diesel oil.

This is perhaps the perfect pest control, replacing a major use of a persistent organo-chlorine compound with something harmless to wild life, cheaper, simpler and safer. It has the handicap of being too simple to patent and offering nothing to sell, so it can never be advertised in the farming press, but every carrot grower in Cambridgeshire will use it, if it fulfils its promise, because it is going to save a great deal of money as well as returning the carrot fly to its proper place in the ecology of our countryside.

Comments

Is all knowledge obtained by the senses?

Empiricists maintain that all knowledge is derived from the senses. What in fact does this mean? In order to answer this question let us consider the infinity of different "senses" made use of by different forms of life and at different moments during phylogeny and ontogeny. Thus the mole has a special "sense", whose exact nature we do not know, which enables it to locate its tunnels even if separated from each other by several feet of earth.

We are descended from a very large number of different forms of life at different levels of complexity, each one of which must have made use of a slightly different set of senses for the purposes of building up its systemic model. One of the principles of behaviour is that information is never entirely lost, but is merely reduced in status.

There is, therefore, no reason why we should not be capable of reviving, under given environmental conditions, many of these mechanisms, which may during phylogeny have fallen into disuse. In support of this thesis is the fact that the range of sensing mechanisms varies with different ethnic groups. Thus the Bushmen are said to have a very powerful sense of smell. It is said that they can detect the presence of an eland or Kudu some distance away.

Australian aboriginal women have a detecting mechanism permitting them to "smell out" live toads very deep in the earth:

"The toads distend themselves with water during the rains, then dig down into the desert soil and skulk there, hoarding their water; the women, whose families are always thirsty, go sniffing about until they come across toad scent, follow it to where it is strongest, dig out the toad, and drag him out and squeeze the water out of the poor creature for their own use."¹

More interesting than this is the in-

formation we have regarding the senses developed by human beings subjected to unusual environments during ontogeny. I refer to children reared in isolation, and those supposedly brought up by wild animals. We find in such children means of perception normally underdeveloped, or entirely absent, in other human beings. Thus Peter, the wild boy of Hanover, discovered in 1724, was said to be particularly sensitive to changes in the weather, which he could forecast with surprising accuracy. Lord Monboddo wrote at the time:

"He retains so much of his natural instinct that he has a fore-feeling of bad weather, growling and howling, and showing great disorder, before it comes on."²

Caspar Hauser,³ who appeared in Nuremberg in 1828 after having spent the first seventeen years of his life alone in a dungeon, was reputedly able to distinguish different colours by their feel. All these children had a highly developed sense of smell. Kamala,⁴ one of the two wolf-children of Midnapore captured in 1920 at the age of nine and subsequently cared for by the Rev. Singh at the local orphanage, was able to locate the entrails of a fowl at a distance of eighty yards. She and other "wolf-children" had also developed the ability to see in the dark.

Thus the statement that all knowledge is derived from the senses does not communicate a great deal of information. For instance, a man who could locate underground tunnels, or who could detect the presence of his neighbours by measuring heat differences, high frequency sounds, chemical trails, tastes, etc., would undoubtedly be accused by those ignorant of the mechanisms involved of making use of some type of "intuition".

Unless we can define what we mean by the senses, the Empiricist thesis can at best mean that all information is obtained by the information-obtaining mechanisms, which does not mean very much to say the least.

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The need for interdisciplinary explanations

Historians are among the most retrograde of all academics. Until recently, they have mainly contented themselves with the tedious chronology of intrigues, wars, battles, etc. Today, the notion that historical material could be used for scientific purposes, i.e. towards attempting to explain the behaviour of humans as organised into communities and cultures, and thus towards building models of social behaviour, has become accepted among a very limited group. Yet to this day, a large number of historians will deny that the study of history has any connection with other disciplines. Their attitude is that history must be studied just for its own sake. It stands alone, its object is some sort of elevating entertainment. Such was undoubtedly the attitude of T. D. Weldon, and H. A. L. Fisher; such also appears to be that of A. J. P. Taylor. In the meantime, more adventurous writers such as Spengler, Marx and, last, and undoubtedly the greatest, Arnold Toynbee, have attempted to put order into the chronology of human affairs, i.e. lay a basis for a science of history.

Though these different writers used totally different methods, they can be said to have had one thing in common, and that is that they attempted to deal with historical material in isolation. They assumed that there was such a thing as "history", as a totally independent phenomenon. They did not realise they were in fact studying the behaviour of human communities and cultures just as an anthropologist does; with the difference that the latter is dealing mainly with contemporaneous communities and cultures, whereas the historian studies their development in time.

Toynbee's study of history is undoubtedly the most stimulating historical work ever written, but it is also the product of one exclusively reared in the humanities. Unfortunately, his knowledge is limited to those disciplines: history, philosophy and the classics, that make up a conventional education in the "humanities". Using exclusively such material, it would be exceedingly difficult to improve on Toynbee in any way. However, if one introduced material from the vast number of other disciplines that could be considered complementary to that of history for the purpose of under-

standing cultural behaviour, one would then produce an infinitely more satisfactory model than Toynbee could, with the miserable means at his disposal.

Thus we learn from anthropology a great deal more about the organisation of communities than we do by examining history, since the subject matter of anthropology is there to be examined. We also learn a great deal about human communities by the examination of animal societies and—since societies are composed of individuals—from all those disciplines that are grouped under the heading of “psychology”. None of these were made use of by Toynbee, but all are now at the disposal of the researcher wishing to build an integrated model of human behaviour at the social level.

Since all such models would make use of different variables, they would be complementary rather than conflicting. Consequently, it would make no sense at all to state, as is often done, that the causes of a particular social or political situation are historical rather than, say, psychological or economic. For every social situation can be explained in terms of a historical model, a psychological one and an economic one, as well as a host of others, whereas a good model could make use of all of these to produce an integrated interdisciplinary one. The fallacy of mistaking complementary models for conflicting ones is commonly made at every level of complexity.

A typical example in physics is that of the two rival theories of matter, the corpuscular theory and the wave theory. Is matter made up of corpuscles or waves? De Broglie showed that both could in fact be true. For certain purposes one theory appeared more useful, while for others the other was preferable. In other words, there is no such thing in the world as a “corpuscle” or a “wave”; these are just variables of two very simplified and complementary models used to represent the most general constituent of the world, i.e. matter. Both these variables are of a fairly subjective nature, since they correspond to concepts that appear in our everyday experience. It is therefore likely that other, more objective, models will one day be developed, using variables that correspond neither to corpuscles nor to waves.

One can quote many examples of this same principle. Let us take an

example from psychology. A great deal of literature is accumulating on the subject of the causes of mental disorder. It appears to be broadly divisible into two types: (1) the work of a biochemical school which “expects to bring psychoses over into the category of organically determined mental disorders”; (2) the work of the psycho-social school, which “shares a common faith that it is in some distortion of the subject’s social learning experience and current social situation that his psychopathology originates”.¹

In the same way, a distinction is made between those psychoses that are supposed to be caused by organic deficiencies and those that are not, even if they have a common symptomatology. Thus, the mental disorders associated with sleeping sickness are taken to be organic because the trypanosome micro-organisms are present in the body fluids. What is taken to be true schizophrenia, whose symptoms are apparently indistinguishable from those of the mental disorders already referred to, however, is classified as non-organic, as no “organic causes” have yet been isolated.

It must be clear that this distinction is false. Mental disorders can only be brought about by some “organic” disturbance. This can best be represented by a neuro-physiological model. Less differentiated and less objective models can, of course, also be constructed in terms of the variables of psychoanalysis or classical psychology. The organic deficiency pinpointed by whatever model we use can then be shown to have some relationship with the patient’s upbringing or social environment. It is clear that an organic deficiency could not have occurred spontaneously or by magic, and clearly a different sort of model is required to explain under what circumstances it came into being. Conversely, upbringing and social environment can be incriminated to the extent that they can be shown to have an effect on the organism. They cannot act in vacuo. Nor can they be considered to act exclusively on the variables of the relatively subjective and undifferentiated model such as the psychoanalytical one for instance. To assume this would be to suppose that the latter model conflicts with the neuro-physiological, i.e. that behaviour can either be explained in terms of neuroses, complexes, repressed emotions, etc., or in terms of

nerve impulses, axons, synapses, but in no case in terms of both. Such a supposition involves a misunderstanding of the nature of scientific explanation. The distinction between organic and non-organic mental diseases would not be made if it were understood that both biochemical and psycho-social models of mental disorder are in fact complementary, and that either in their present or in some modified form, both could be integrated into a general model.

This same principle applies equally well to the solution of problems considered to fall within the scope of anthropology. Thus Murdock,² on the problem of the explanation of incest taboos, shows that no explanation can be given in terms of the variables of a single discipline. He writes:

“No unitary theory of incest taboos appears capable of accounting for all aspects of the phenomenon of incest prohibitions. For a satisfactory interpretation, it is necessary to draw upon the scientific contributions of several disciplines which have concerned themselves with human behaviour. A full explanation, indeed, requires a synthesis of the products of no fewer than four distinct fields of scientific endeavour, namely psychoanalysis, sociology, cultural anthropology and behaviouristic psychology. When specific contributions from all of these disciplines are put together, a complete and adequate theory emerges. When any one of the four essential elements is omitted, however, the phenomenon remains mysterious and unexplained. In other words, a satisfactory theory of incest taboos has had to await the recent development of interdisciplinary and integrative research in the several sciences that deal with human behaviour.”

Unfortunately, interdisciplinary work is seriously handicapped by the difficulty of communication between researchers in different disciplines, using radically different classificatory systems, while the integration of the corresponding complementary models into a general behavioural model will only be possible once a unified terminology has been developed for science as a whole.

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Ecotechnics

by Arthur J. Puffett

Prevention of marine pollution

A Bill now before Parliament, "Oil in Navigable Water", will make the sea around our coast a prohibited dumping zone except for very limited discharges of oil, and will increase penalties for illegal discharges.

Whilst legislation will curtail the blatant washing out of oil tanks and similar practices on ships, accidents will still occur, and the search for new methods of oil dispersal will therefore still be necessary.

Several ways of handling both sea and inland water pollution by oil have been developed in the last twelve months which are worthy of mention. It should be emphasised however that no single system yet developed can handle the quantities of oil which escaped from the now infamous *Torrey Canyon* disaster—100,000 tons—and the recent *Pacific Glory* incident should make us aware that with the increasing size of tankers (a 500,000 ton vessel is already under construction in Japan) the chances of an oil spill of enormous magnitude cannot be ruled out. Indeed, as the authorities are painfully aware, isolated cases are virtually certain to occur, making the dispersal problems far more immediate.

Designed by the Warren Spring Laboratory of the Department of Trade and Industry, Britain's standard equipment for dispersing oil slicks resembles six large wooden garden gates trailing in the sea behind an ocean-going tug fitted with two booms fitted with sprinkler nozzles. Although extremely simple—the whole device costs £300—it is effective.

Detergent is sprayed on to floating oil and the resultant mixture is churned up by the following "gates". One tug can disperse 150 tons of oil a day, and sixty of these units are now deployed at ports around the coast to deal with any reported slick.

Used on the *Pacific Glory* slick, the sand slurry method developed by the Shell exploration and production laboratory for Shell International Marine, is at present the only system which can deal with large areas of floating oil.

Warren Spring is collaborating with Shell on this project, which involves spraying a slurry of amine-treated sand from wide ship-borne booms. As the sand, unlike detergent, is non-poisonous it is far less likely to cause destruction of wildlife. In extensive trials conducted during 1970, over 95 of every 100 tons of crude oil sank in small globules within 45 minutes.

Both Shell and Warren Springs emphasise that the sand technique could only be used on large oil spills because of the cost, and that it could not be used over marine spawning grounds.

A unique method for cleaning up ocean oil spills has been designed by Ocean Design Engineering Corp., Long Beach, California. Capable of actually recovering oil, in the open sea with severe wave action, this system is obviously superior to its competitors, although the initial and operating costs of the containing vessel is far greater.

ODEC's method involves spraying large quantities of urethane foam chips on to the surface of the water, in a free-floating state. The foam chips absorb the oil but repel the water, and as the recovery vessel moves forward through the slick, the foam is contained by booms, collected on a conveyor belt and lifted to a compression unit. The oil is then squeezed out of the chips, which are then sprayed back on to the oil slick.

The major advantage of this system is that the foam is not affected by wave action, since the chips follow the water surface and are not, unlike other foam/oil gathering methods, mechanically submerged by the rise and fall of the recovery vessel.



Megator Alpha Skimmer being positioned to recover an oil spill

In protected waters the system is mounted on a 30 ft catamaran fitted with twin harvesting booms. Recovered oil is stored in the twin hulls, allowing a capacity of 3,000 gallons.

Designed for transportation by road, the booms, hulls, control house, drive units and conveyors can be easily assembled or dismantled.

ODEC are also developing an open sea system, which may be attached to a small tanker, capable of cleaning an oil slick 80 ft wide at the rate of 60,000 gallons per hour. The equipment can also be mounted on any ocean-going vessel, oil storage facilities being provided by large rubber containers towed behind the vessel.

Developed by Megator Pumps & Compressors Ltd., 151 Gower Street, London SW1, the Megator Alpha oil spill recovery system provides a practical means of cleaning up floating oil spills in inland water, harbours and estuaries without the high cost, special clothing, fire hazards and toxicity problems associated with emulsification. It is normally operated in conjunction with a boom, of either permanent or emergency type, or a fixed interceptor, but can also be used in the absence of such equipment.

The relatively inexpensive equipment comprises a Megator Alpha skimmer, a Megator sliding-shoe pump with direct-coupled gasoline, diesel, compressed air or electric driving unit, a Megator floating hose suitable for suction or delivery and receptacles for the recovered oil.

Floating on the surface, the skimmer assembly is designed to bridge the boom so that it can be launched and manipulated from the clean side. Weighing approximately 55 lb (25 kg), the skimmer can be handled by one

man, whilst the whole pump set, complete with driving unit, can easily be carried by two men. Alternatively, the set can be supplied mounted on a mobile chassis or a trailer.

Floating oil is sucked in by the skimmer, diverting the underlying water downwards. The success of the system, which was recently flown out to America at the urgent invitation of the Tri-State Pollution Prevention and Clean up Committee and demonstrated on the Ohio River, is largely due to the Megator sliding-shoe pump which will operate on air, water, or a mixture of both for indefinite periods without damage.

A system of burning slop oil in ships, instead of washing out the oil at sea—at present one of the major causes of oil pollution—is offered by the Nopol mechanical-electronic system. Cities Service Tankers of New York, who have developed the system in conjunction with the Todd Organisation and Combustion Engineering, estimate that the cost of installing such a system is recovered in six voyages.

Designed to burn crude oil, waste slop oil or bunker "C" fuel at the turn of a switch, the system provides reductions in tanker operating costs with arrival at loading ports with clean ballast.

The Nopol system involves three distinct stages of processing. Clean water is drawn off from the tank washings and pumped overboard, limiting the amount of oil/water and emulsion to be treated. Crude oil and salt water from tank cleaning operations tend to form very stable emulsions which are broken up using chemicals or emulsion breakers, causing the water and oil to separate.

The second stage reduces the volume of remaining oil/water mixture by natural gravitation separation, assisted by a chemical process. Finally, the remaining water is removed by a special procedure, leaving oil which can be pumped direct to the ship's boilers, where it can be burned without pre-heating.

It has been estimated that some 600 barrels of slop oil can be recovered on a normal ballast voyage by a vessel of some 70,000 tons.

Designed to preclude any overboard discharge from toilets and urinals whilst a vessel is in port or restricted waters, Yarrow Engineers (Glasgow) Ltd., have introduced the "Elsan Yar-

row" sewage treatment plant for use in ships. The system operates as a closed circuit, in a re-circulating flush system. When at sea, the system may be isolated and the normal sea water flush system operated.

Chemical treatment of the sewage separates it into sullage and a sterile liquid which is re-circulated in the flushing system. By eliminating the need for outside flush water, the problem of inboard storage is reduced to minimal proportions since the sterile effluent rejected from the closed circuit to storage equals the amount of raw sewage entering the system. Using the "Elsan Yarrow" system, a day's sullage will approximate 30 gallons per 100 people, unlike a system utilising outside flush water which would be about 1,200 gallons per 100 people per day.

The raw sewage passes through a comminutor, which shreds any paper, vegetable matter or other solids, to a settling tank. It is then fed into a chemical dosing tank where it is mixed with the two chemicals which achieve the sewage breakdown. The liquid is continuously circulated in the system, the settlement being run off to storage when the settling tank level reaches a pre-determined level.

Being completely chemical, the system is not affected by detergents (unlike aerobic systems), and will stay hygienic under overload. The system has raised worldwide interest, especially in Canada and the United States where pollution of the Great Lakes has become a political, as well as an economic, concern.

Computers speed ecological studies

Honeywell's Systems and Research Centre, at Roseville, Minnesota, are using computers in a research programme designed to provide faster, more detailed knowledge of the earth's resources.

The Honeywell programme uses electronic scanners, sensors and computers in interpreting aerial photographs of forests. In a fraction of the time it would take a human "reader", the electronic system can analyse photographs and tell the species and size of trees in a given forest tract. The company says the classifier has potential use in crop management, water resources and urban development, as well as forest "labelling".

A series of aerial photographs is taken of a predetermined area, from either an aircraft or orbiting satellite. A skilled photo interpreter studies the photographs and assigns symbols to identify typical features such as texture, density and shape. He then programs the computer to extract automatically those features of interest, ignoring other material.

A series of photos in the area being studied is then fed into the classifier, which evaluates them in minutes, rather than the hours or days it takes a human interpreter. The computer is not subject to human variables that may change from day to day or from interpreter to interpreter. It can reject data such as building or vegetation whilst evaluating a photograph for water pollution caused by effluents in lakes or streams.

Honeywell believe the use of machine scanning has great potential. For example, it can indicate population trends and economic level of communities by determining the number of homes of a certain size or value in a particular area. The amount of landscaping and size of lots also are indicators of property value.

There is also application for surveying earth resources and finding areas of geological significance, such as mineral deposits. The application is even more obvious to aerial surveys of farm or ranch lands and to location and inventory of vegetation or extent of surface water in large geographic areas.

Aerial surveys can indicate when to harvest crops and where diseased areas are located. They could also be used to identify animal life and measure species population.

President Nixon has offered to make the company's capabilities for studying earth resources available to emerging nations, who know far less about their own economic potential than the developed nations know of their own.

The system's ability can be measured from the following example.

It takes the US Forestry Service about ten years to survey the nation's forests by the present aerial photograph method. At the end of this period the whole study can be obsolete, and it takes a further ten years to make a second study. Using the new system, Honeywell believe the entire census could be made in 100 days.

Feedback

1 Smog for sale

In 1970 every American enjoyed three-quarters of a ton of poisonous smog in the air he breathed. It cost him \$65. Put another way, the U.S. government found that air pollution last year reached nearly 142 million tons and cost the taxpayers \$13 billion.

Sunday News, New York

2 Money to burn

The US Treasury has joined the fight against air pollution by deciding to recycle \$9 billion in worn out bank notes instead of burning them every year.

Mrs Dorothy Kabis, treasurer of the United States, said that residues from the 2 billion bills weighing 2,500 tons remained in the air as irritants. The old currency is now converted into pulp which can be used again, as housing insulation, for example. Regulations requiring that old money be destroyed only by burning have been changed to include the new process. *The Evening Star, Washington*

3 Mad bomber strikes again?

An industrial scientist has come up with the idea of getting rid of waste by an endless series of H-bomb explosions.

According to Dr David R. Safrany of Bechtel Corporation, Chicago, exploding 50 to 100 thermonuclear bombs a year in underground caverns could vaporise America's sewage, garbage and other organic wastes into basic elements and chemicals, which could provide the world's cheapest fertilizer as well as a cheap new fuel for everybody's car.

"Sure, it sounds wild," said Safrany. "Sure the ground might shake a little. And sure, it's one that needs a lot of work and study, including ecological effects. We're not going to do this tomorrow. But we have to

start thinking of imaginative new methods if we're going to dispose of our wastes and still breathe the air and drink the water."

Safrany's process would require explosion sites, probably salt domes. Some of these dry, underground areas scattered around the country already possess caverns; for those that don't, Safrany would explode an H-bomb to make one.

"Sure, we'd be better off probably without any underground explosions," said Safrany. "But we have to consider some trade-offs if we want as clean as possible an atmosphere."

Ecologists have yet to comment on Safrany's proposals.

The Washington Post

4 Suffolk bans detergents

Long Island's Suffolk county recently took a step unprecedented in the USA by banning the sale of virtually all detergents used to wash clothes or clean homes.

Like most rural areas Suffolk County has no major sewer system and because its 1,200,000 residents depend on backyard cesspools and septic tanks, household wastes—especially detergents—eventually seep into the underground water supply. As a result drinking-water looks, smells, and tastes bad and perhaps affects human health.

The ban goes into effect on 1 March and anyone who sells detergents may be fined up to \$250. The problem is that the detergent industry has not developed substitute soaps which break down in nature and are effective too. But the Suffolk County law will undoubtedly encourage them to come up with something fast.

Time

5 Detergents kill rats

Experiments with rats have caused new doubts on the safety of enzyme detergents. According to three New

York doctors rats died or suffered "severe respiratory symptoms" after a single exposure to two common detergent enzymes.

The doctors say that health hazards of enzyme detergents "haven't been adequately investigated".

The US Federal Trade Commission and the Food and Drug Administration have received complaints that enzymes may cause dermatitis, inflammation and irritation of the skin, asthma and other respiratory disorders.

The two agencies have invited representatives of the Soap and Detergent Association to discuss the need for additional research into the safety of enzyme detergents.

The Guardian

6 50,000,000 victims?

As many as 50 million Americans may be suffering from a variety of ailments ranging from fatigue to sexual inadequacy because of air pollution according to a New York doctor.

Dr Albert A. La Verne said his estimate of what he called the specific air pollution syndrome was based on a controlled study of 100 New Yorkers, who were made to breathe, alternatively, polluted air and pure air while sleeping. His subjects were "normal" people, whose complaints included headache, anxiety, backache, irritability, impotence, frigidity and premature ejaculation.

After breathing pure, compressed air during sleep 72 per cent showed improvement ranging from "mild" to "marked", said La Verne.

Daily News, New York

7 Even New Zealand

"No swimming in five years, no trout in ten years and no trips to Mokoia Island without gas masks." This was the first grim prophecy of Mr P. J. Burstall, a New Zealand conservator of wildlife on the future of Lake

Rotorna if the algae menace is not contained. Now, in a recent article in the journal of the Society of Health, he again issues a warning against poisoning of the lake with sewage, pesticides, detergents and other matter on which algae can feed and proliferate. Cannily tuned in to the real as opposed to the rhetorical anxieties which will get home to the public, Mr Burstall eschewed sentimental appeals to nature lovers or aesthetes or explanations of ecological necessity. He just laid hard cash facts on the line: if the lake were not cleaned up, pollution would eventually cause a 90 per cent drop in lake-shore land and property values.

New Zealand Herald

8 Blue skies and red dragonflies

The Japanese government has printed 12,000 posters depicting children chasing red dragonflies flying in clear blue skies over Tokyo. These are, rather ironically, part of the Japanese capital's month-long anti-pollution campaign under the slogan "Red Dragonflies for Tokyo again". Industrial plants are being asked to use heavy, low-sulphur oil and helicopters are keeping a strict watch over chimneys in the metropolis. To control vehicle exhausts, carbon monoxide and lead content is being measured at four points in the city and a determined campaign is aimed at reducing city noise. *Japan Times*

9 New cancer threat

Fish and seafood, which is being increasingly contaminated by oil spills, represents a cancer hazard concluded leading Western scientists at a recent NATO sponsored conference on sea pollution in Brussels.

Dr Max Blumer, senior scientist at United States Oceanographic Institution at Woods Hall, Massachusetts, estimated that the annual oil influx to the oceans was between five and ten million tons.

"Carcinogens, or cancer carrying elements, have been recently found in crude oil but additional efforts are needed to define further their concentrations and types in different crude oils and oil products," he said.

Dr Blumer claimed that there was increasing evidence that fish and shellfish which are hazardous to health

have been and are now being marketed. He called for the creation of public laboratories for the analysis of fish produce for toxic chemicals derived from oil.

"I do not wish to alarm people, but I feel very strongly that the public health authorities must be alerted, just as they have been on cancer danger from smoking," he said.

Daily Telegraph

10 Where the answer lies

The two main soil structure research stations in Britain are in the wrong places, according to Professor Walter Russell, emeritus professor of soil science at Reading.

The stations, at Rothamsted and Hurley, were both on dark coloured soils which presented few problems, he said. "If Rothamsted had been in Lincolnshire instead of Hertfordshire we would have been miles ahead on research in stabilising soil structure."

The Guardian

11 Ruckelshaus knuckle-rapper

"We're going after the polluters." This declaration by the Administrator-designate of the new Environmental Protection Agency wraps up the goal of the organisation that will administer the major Federal pollution control programmes.

William Ruckelshaus, who made the remark after President Nixon announced his nomination, must win Congressional approval before assuming his post.

At the White House, Russell E. Train, chairman of the Council on Environmental Quality, will continue to develop environmental policies for the executive branch. When particular programmes are implemented, the Environmental agency will assume their enforcement and regulation.

Asked about industrial pollution, Mr Ruckelshaus pointed to "many existing laws, both at the national and state levels," that must be enforced. His agency, he said, would develop "new means of convincing industry that these laws have got to be obeyed."

United States Information Service

12 High up the poll

Environmental pollution is among the five top national problems worrying

Americans. Only Vietnam, campus unrest and inflation take priority on America's worry list according to a recent Gallup poll.

That this concern over pollution was real was reflected in the returns from the mid-term elections. Americans approved a variety of ballot propositions designed to improve the quality of life, and environmental problems were campaign issues in 25 out of 50 states.

The New York Times and an organisation known as Environmental Action, both reported that more than one thousand million dollars in anti-pollution bond issues were approved by voters of five states in the elections.

"The amount was big, but it was not enough..." said Denis Hayes, director of Environmental Action, "we still have to go a long distance before we reverse the pollution trend."

United States Information Service

13 Canned!



The Can Disposal Operation started by Kaiser Aluminum and Chemical Corporation is well under way. The picture shows one of Kaiser's employees buried under some of the 6 million all-aluminium cans which have been collected so far. The scheme was introduced in California to help solve the litter problem. Individuals receive 10 cents per pound for the cans which are then recycled.

14 Fight like hell

Makers of motor cars in the US have launched an intensive behind the

scenes fight to weaken a tough air pollution control bill aimed at sharply reducing auto pollution by 1975.

"We're not looking for a big public showdown," said one industry official. "But we're going to fight like hell—we're going to call in all the chips that are owed us on this one."

The bill passed the senate by a 73 to 0 vote and would establish stringent air quality standards for most US cities by 1975. To achieve this cleaner air, an almost pollution free car would be required in five years.

"It isn't a question of whether we can technically meet the standards with existing devices—we do it every day in the labs," said a General Motors spokesman. "The problem is whether we can have it on all cars—the mass production problem—by 1975. This we can't do."

The Boston Sunday Advertiser

15 Wish-bone fulfilment

A midget hen, nearly a third smaller than other hens, is on the way to being produced by scientists so that poultry farmers can save on food and housing costs. It will mean that three hens can be kept in a battery cage which would normally hold only two.

Work on the project by an American poultry firm is still in the experimental stage, but more than 250,000 mini-hens have already been produced by using a dwarfing gene and are under observation.

The company, Hyline Poultry Farms, also operates in Britain. Its chief geneticist, Mr Mert Hansen, says that the new bird eats less than full-size hens but produces eggs of normal size.

"As it requires only about 11 lb of feed to take a midget from one day-old to 22 weeks, when they start to lay, compared with 16 lb for a conventional bird, it is possible to rear three birds virtually for the price of two."

From the eight-week stage, when the dwarfing gene begins to show its effects there is also a reduction in the space needed to rear the birds.

Daily Telegraph

16 Doomster changes tune

Anti-pollution crusader, Barry Commoner, believes that the federal government will ensure that the U.S.A. and mankind survives.

Grass-roots activism will goad

Washington into strong national policies to protect the environment, he predicted.

Encouraged by the actions of local anti-pollution groups over the last year, Commoner believes that such local activity is the forerunner of national policy.

"I'm very optimistic," beamed Barry. "I really think we'll survive."

Chicago Daily News

17 Sternglass, loner

Claims that radiation emissions from the Dresden nuclear power reactor near Morris, Pennsylvania have caused an increase in the infant death rate in counties downwind from the plant were refuted by spokesmen for the Atomic Energy Commission and Commonwealth Edison Co.

The charge was made by Dr Ernest J. Sternglass, a professor of radiation physics at the University of Pittsburgh, who called for the new plant to be shut down until new equipment could be installed to remove the radioactive materials in the smokestack exhaust.

Byron Lee Jr., assistant to the president of Commonwealth Edison, said he was "very sceptical" about Dr Sternglass' charge. He said he is confident that the emissions from the plant posed no public health hazard.

A recent study by the United States Public Health Service said that the radioactivity from the emissions was only a fraction of the natural radiation found in the rocks and dirt in the area and that these emissions were well within AEC safety standards, according to Lee.

Chicago Tribune

18 Death in the potting shed

Over the past few years there have been a number of deaths caused by weed-killers, in particular by one of the most widely used preparations, paraquat, according to a recent report from Dublin.

Out of 15 cases of poisoning, nine proved fatal—all of them due to paraquat. Although the amount of paraquat ingested in the various cases differed considerably, as little as one mouthful could be lethal—even though this was at once spat out.

Treatment of paraquat poisoning requires immediate forced diuresis. Even lung transplantation has been

advocated as a life-saving procedure. But scrupulous care in the storage, distribution and use of this compound could save lives, said the report.

Pulse

19 Mr Clean's alter ego

A new conservation group called the Oceanic Society, which will sound the alarm when anyone or anything pollutes the seas, was formed recently in San Francisco.

Radioactive wastes, pesticide residues, mercury, lead, petroleum and all the other poisons that now enter the sea from man's activities will also be targets of the group's surveillance.

According to George C. Kiskaddon, chairman of the new society, the group intends to sponsor a floating marine sciences laboratory in San Francisco Bay and set up a pollution monitoring station on the Farallon Islands. It will also promote native fisheries and marine-orientated industries that will remain in balance with the local environment.

One of the main goals of the Oceanic Society will be an international agreement to penalize all ships that dump sewage and wastes into the seas. "The ocean is becoming the sewer of the whole world," said Kiskaddon, who ironically contributes to this sorry state of affairs in his other capacity as president of a group of shipping firms.

San Francisco Chronicle

20 Bugs vs. bugs

To combat California's rampant mosquitoes, which can no longer be controlled by D.D.T., researchers hope to develop new pesticides, but mainly for "emergency" use. They now prefer to use the bugs' natural enemies.

The Culex mosquito, for example, can be controlled by the mosquito fish and the common guppy which eat mosquito larvae in water. Another method includes releasing large numbers of male mosquitoes of the same species but of different strains. Because of genetic incompatibilities, the eggs of the females fail to hatch.

Fortunately there is no lack of natural enemies. The problem is how to spot the one most likely to exterminate California's menacing mosquitoes while also ensuring the new parasite will not upset the ecology of the region.

Time



Books

Threatened Atoll

ALDABRA ALONE by Tony Beamish, George Allen & Unwin, 50s.

In his obsession to kill his fellow humans—or, put as generously as possible, to shield himself from being killed by his fellows—man has a long and appalling record of annihilating lesser forms of life, both vegetable and animal. Napalm and defoliants in Vietnam are only the latest horrifying instances. Wherever the military treads, in peace as in war, it exterminates life. And these days it treads almost everywhere; in the interests of “defence”, no place is out of range of the sights of the airbase-builder or staging-post planner or military-harbour blaster.

During the past 20 years, as Tony Beamish observes in this valuable, handsomely illustrated book, many remote ocean islands have “succumbed to the military strategist with hardly a word of protest, although the menace should have been foreseen.” Where those dots in the blue sea were not already irretrievably damaged by greedy settlers and guano diggers (e.g. Assumption Island where all the resident sea birds and all the natural vegetation have been wiped out), the airbases have arrived to do the ruin-ation. Uninhabited isles have been the most appealing to the military (no awkward human beings to obstruct things), yet it is just such ocean islands that “are of especial scientific interest not only because they are breeding grounds for vast populations of sea birds and marine mammals and reptiles... but because their flora and fauna, evolved in isolation, are often unique.” And so—only two examples—we have the Laysan albatross nearly eliminated on Midway, and practically all the native vegetation of Ascension destroyed by the military’s “war” on ecosystems.

The Indian Ocean atoll of Aldabra was a recent candidate for such destruction; it had been saved, for the time being at least, only by a campaign of (ironically) almost military precision and power, waged by outraged scientists from all over the world and led by the heavy guns of the Royal Society and American Academy of Sciences. An Anglo-American treaty of 1967 had designated Aldabra as a suitable site for an

air staging post, suitable (so the soldier mentality had it) not only because of its geographical situation but because it was practically uninhabited, the principal residents some very odd birds and reptiles of no apparent value to mankind. And so it came as something of a shock to the British Ministry of Defence and the US Defense Department that their opinion of Aldabra’s suitability was not shared by all, that in fact the atoll was one of the few places left on earth practically undisturbed by man, a unique habitat which—the opponents of the military argued—ought to remain so. Eventually the opponents won; the airbase project has been shelved indefinitely, though not actually cancelled.

In this record of the battle to save Aldabra, together with an account of his visit to the atoll in 1967, Tony Beamish makes it clear just what would have been lost if the plans of the military spoilers had gone unchallenged. Aldabra is the last home of the giant Indian Ocean tortoise (80,000 now breed there). It is the breeding ground for the frigate bird of seven-foot wingspan, the red-footed booby and the red-tailed tropic bird. Also, Aldabra alone of the Indian Ocean atolls has never been mined for guano, and so retains most of its original vegetation; of some 170 species of plant so far identified, no less than 18 are unique. Altogether, as a Royal Society memorandum about the atoll, paraphrased by Beamish, put it: “Such ecological principles as the working of population control mechanisms in a natural environment, where evolutionary pressures and their results are not hidden under a mass of man-made disturbances, could be investigated on an intact Aldabra. There were few other places where such opportunities existed.”

Aldabra, as Beamish describes it, is “a platform of eroded limestone, the remains of a coral reef that once flourished on top of a submerged volcano,” and its most distinguishing features are the mushroom-like lumps of eroded coral rock: “some hardly larger than a round banqueting table with the single ‘leg’ so thin and eroded that it could barely support the circular top. Others much larger, in an earlier stage of solution by the tides, and resembling warships with the superstructure replaced by coarse vegetation.” Not it seems a comfortable place for man—the coral mushrooms are like razors to the foot—but a paradise

for wild life, not least because of its very uncomfortableness for man.

Beamish, as an entomologist and conservationist, records his surprise, horror almost, at a small incident which is a paradigm of how that paradise could be so swiftly spoiled by man. One day, while his expedition was circling the atoll by boat, they approached one of the circular coral platforms, upon which a colony of grey noddy terns was nesting; in a flash, a creole guide leapt on to the platform, then back into the boat carrying two handfuls of eggs. They were to appear on the expedition’s breakfast table next morning. An unprotected and fairly common sea bird the noddy may be, but the blatant robbery of the incident rightly impressed Beamish and reinforced his opposition to plans for the airbase.

The fate of the Indian Ocean giant tortoise is proof of just what can happen. Until about 200 years ago, the tortoise abounded on at least 30 islands of the Indian Ocean, but man’s slaughter of them for their tasty meat and the destruction brought by man’s domestic animals are documented by Beamish: “Goats, cattle and horses competed for the limited supplies of green fodder and, being more nimble, beat the slow tortoise to it. More aggressive animals like pigs, dogs and cats attacked their soft-shelled young and ate their eggs whilst man’s accompanying horde of rats added drastically to the slaughter. The giant tortoise was unused to predators. It was meeting competition and facing aggression for the first time in millions of years. The outcome was a foregone conclusion.”

The tortoise, all of Aldabra’s rich and varied wild life, now has a reprieve, but at least two threats remain. Since the airbase project was shelved in November 1967, both the American and British electorates have moved to the right: it is not inconceivable that Britain’s new Tory government, dedicated to an “East of Suez” military presence, might well brave the wrath of the botanists and zoologists and revive the Aldabra project. Then too, there are the botanists and zoologists themselves, now flocking like sacred ibis to Aldabra. Fortunately, as Beamish observes, they are more likely today to press the shutter of a camera than the trigger of a gun in their search for records of rare species, and “taxonomy today embraces animal behaviour and

habits, a requirement which also tends to reduce the need for slaughter." Even so, on his record, meddling, destroying man is not to be trusted—not even the most innocent appearing bug hunter. The future of Aldabra needs to be carefully watched.

John Barr

Gardener's friend

PEST CONTROL WITHOUT POISONS, by Lawrence D. Hills. Henry Doubleday Research Assocn., 20 Convent Lane, Bocking, Braintree, Essex. 3s 6d.

Now in its second edition, this book is basically a comprehensive survey of garden pests and instructions and hints for their control, avoiding those products which may be harmful to other forms of life. The first approach that is recommended is to outwit the enemy. The chapter on "Pest Control by Cunning" lists 20 fruit pests and 10 that attack vegetables. They may be tricked or trapped, says Mr Hills. Leatherjackets, for example, which are the larvae of the crane-fly (daddy-long-legs) come to the surface to pupate. They prefer moist conditions which make the earth softer. If the ground is well watered and covered with a sheet of polythene or tarpaulin an artificial damp night is created beneath. The sheeting may be removed after a few hours and there are the leatherjackets, waiting for the garden roller. The birds will do the rest.

There are occasions, however, and pests, for which subtlety is not enough and a chemical control is unavoidable. The book lists the safe pesticides and describes 31 pests, diseases and fungal conditions and how to control them. It goes on to discuss insect repellants and it outlines areas of research which the HDRA is pursuing through its network of enthusiastic amateur scientists.

Mr Hills tells us that only two forms of predator control have worked successfully in this country: he heads the section "biological control" but this is usually taken to refer to more than just predator control. It is possible that ways may be found of improving the survival rate of native predators and this is a line the HDRA is following.

The Association's president, Robert S. W. Pollard, is a lawyer. He contributes a section on the laws relating to garden chemicals. He writes in a question and answer form, assessing responsibility and liability for a range of domestic disasters arising, directly or indirectly, from the use of common pesticides and herbicides.

Pest Control Without Poisons ends with an appendix listing the manufacturers of the safe garden chemicals which should be obtainable through any good garden supplier but which, in practice, the reader may find difficult to locate.

There are millions of amateur gardeners in Britain and although many of them buy commercial products with known ecological side-effects, there are many more that prefer not to. For them the 60 pages of

experience and advice that Mr. Hills has collected is a bargain.

Michael Allaby

Sterile surface

CHALLENGE FOR SURVIVAL. Edited by Dr P. Dansereau, Columbia University Press, 72s. Paperback 25s.

There's money in ecology; so many books are coming out each month that it is impossible to keep up with them all. This is not necessarily a good thing for the growing environmental movement. After a while, boredom sets in, and "public awareness" is not so much heightened as over-saturated. Books like *Challenge for Survival*, whose titles disguise their total inability to come to grips with the real problems, contribute to this process.

This is not to say that it is impossible to write clearly and simply on the urgent topics with which *Challenge for Survival* is supposed to be concerned. The tradition of pamphleteering is long and marked with success. But to do this, authors must descend from their clouds of so-called scientific objectivity. They must accept not that "much remains to be done" as several of the contributors to this volume would have us believe, but that "virtually nothing has been done", and most of that little bit is worthless.

Take wilderness preservation, on which this book expends five of its twelve major essays. As Dr Paul Ehrlich explains in *The Population Bomb* the basic problem is simple: too many people, occupying too much space, consuming too much of the earth's resources too rapidly. It is inevitable that wilderness has almost ceased to exist all over the world when the number of humans in it is doubling every 35 years.

What do the contributors to *Challenge for Survival* have to say about this? Next to nothing. They are far more worried that such essential amenities as parks—filled with caravans—and clean seas—covered with pleasure boats—are maintained. It is patently ridiculous to choose as top priority the buying up of areas of wilderness to protect them from being built up or converted into motorways, factories and slag heaps, when the disaster before us is of truly Malthusian proportions. This is not to say that I prefer slag heaps to wilderness, but the surest way to cease to survive as a civilisation (or even as a species) is to ignore what the simplest exercise of common sense tells us: cut back population, and all other forms of growth now, or go under.

This message is vastly unpopular. It is so much easier to talk about the preservation of open space amenities in predominantly upper class areas. If suburbia and the "right side of the tracks" choose to beautify their part of America, all power to them. But let them not, please, pretend that they are working for the benefit of us all.

Nowhere on earth is this more evident than in New York, where the conference,

from which this book was assembled, took place. One need only walk the streets to see that elementary sanitation has broken down, or visit half the dwellings there, where rats compete with cockroaches for garbage. The air is foul, the water decreasingly potable. In short, New York contains all the prerequisites of a plague. To fail to see this must have been an act of wilful blindness.

It is worthwhile to delve into the reasons for the overwhelming failure of this book, if only because we can expect similar conferences and teach-ins to take place in Britain in the near future. Just as it is possible to learn from the way the US is destroying itself as a human habitat, so we can follow American efforts to extricate themselves and learn from their mistakes.

Pollution control and all the rest are logically simple, and practically impossible to implement. Enormous amounts of money, and great blocks of vested interest are involved. Politicians are unwilling to vote for expensive measures which are difficult to explain to their constituents. The example of the Clean Air Act indicates that change is only possible after a lot of people have died.

Many manufacturers simply will not pay for effluent control unless forced to. Even when the evidence is clear, they will hire experts to "prove" that their most dangerous actions are innocuous.

And in the few cases where industries have been forced to abandon dangerous practices, they push the entire cost off on to the consumer. Even this may be asking too much. Higher prices may mean lower demand, and ultimately less profit. We mustn't have that, no matter what!

This is not to say that all industrialists are irredeemably vicious exploiters of all of us for private gain, though some may be. Certainly, the men who continued to promote stable insecticides and Thalidomide after the dangers of these substances were clear to all, fall into this group. But the rest are simply doing their duty to the shareholders. They will only do their duty to all mankind when forced to.

The other central problem is Calvinistic: We are all guilty. The earth cannot support indefinitely the production of all the things we are coming to demand, nor can its ecosystem detoxify the by-products of this level of industry. We are going to have to accept less. Less cars and less power, but also less cancer and emphysema.

Therein lies the real challenge for survival. Can we, collectively, moderate our greed and procreative urges?

It is unfortunate that the few authors of this book who know this only too well, men like Dr Ian McHarg, Dr George Woodwell and Lewis Mumford allowed themselves to be obscured by the woolly-mindedness of their fellow contributors. For, as Mumford points out, unless we are very lucky and very active in the right directions, the earth may become "a planet no more fit to support life than the sterile surface of the moon".

Francis Arnold



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The Ecologist
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Letters

Sex determination

Sir,

I think it is now becoming generally recognised that the population of this country and the world as a whole must be controlled and even reduced. Potential parents would much more readily submit to having only two children if they were able to determine the sex of these children. For this reason, research into the determination of sex in pregnancy is of the greatest importance. We are riding the back of the tiger (runaway technology) and we might as well use it to our advantage wherever possible.

Yours sincerely,

James Graham.

19 Pembroke Square, London, W8.

Return of the airship?

Sir,

Thanks to Basil Clarke for his interesting article on airships. We feel something further should be done towards achieving a reevaluation of the potentialities of the airship.

We are interested in co-ordinating the planning and construction of a new airship on a non-commercial basis and various resources we have available make this a practicable proposition.

If anyone has experience of airships or information about them, has design training or is willing to offer time or materials towards this project, would they contact me? In fact, if anyone is interested in this form of travel, please write.

Yours sincerely,

Colin Haynes.

Formby Un-Tied Workshop, Formby Hall, Formby, Lancashire.

Brotherhood of Man

Sir,

You have already published one letter taking Mr Goldsmith to task for his pronouncement concerning the brotherhood of man (*The Ecologist*, August 1970). May I ask you now to publish another. I want to come strongly to the support of Dr Eric Albion (*The Ecologist*, October) when he says in his letter that we must think of the brotherhood

of man as a necessity if only because of the restricted surface of our planet. I would go much further than this. The brotherhood of man is more than a goal for us to strive for, an ideal not yet realised. It is an established fact with as sound a scientific basis as any fact could have.

First and most fundamental, mankind comprises a single inter-breeding species, and the so-called ethnic groups (what incidentally is an ethnic group?) are geographical varieties distinguishable only by superficial characteristics. Next there is the equally important matter of descent. Each individual human being, from the genetical point of view, is the product of the great and unbroken stream of inheritance which has its source, not in his parents, not in his immediate ancestors, but in the earliest human beings a million or more years ago. If Mr Goldsmith requires unequivocal affirmation of this article of faith (yes, it is certainly that as well) from an eminent living biologist, I can refer him to *Scientific American*, (September 1962, p. 265), where Sir Gavin de Beer, reviewing a book by another and equally eminent biologist, writes, "from the beginning of the evolution of man on earth it is literally and scientifically true that all men are brothers."

As for historical evidence in favour of the paramount importance of the healthful mingling of races and cultures, Dr Albion has referred to it in his letter, and indeed it is overwhelming. Civilisations, nations, the more vigorous and creative in particular, social communities at almost every level, both primitive and sophisticated, have become what they were and are as a result of the fusion of cultures and ideas, following, it is true, upon some degree of initial rejection. Mankind is one species, so this should be thought of, not as hybridisation, whose consequence is sterility but as a necessary cross-pollination, whose consequence is development and diversity.

Finally may I point out that this sense of brotherhood and unity is of primary importance in the environmental crisis which confronts us today. There is a brotherhood of mankind, and it is a part of a greater brotherhood of all living things, while that in its turn is part of a yet greater brotherhood embracing all things in the universe, whether living or non-living, from elementary particles out to the remotest galaxy. Unless we realise that, how can we understand the enormity we are committing

against the ground of our being, and in consequence directly and catastrophically against ourselves?

Yours sincerely,

Leslie Reid.

Chapel Cottage, Thornborough, Buckingham.

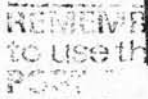
Supersonic albatross

Sir,

Jean Liedloff's article "The Supersonic Albatross" in the September issue of *The Ecologist* appeared to me so biased as to be unworthy of your excellent magazine. Your avowed aim is the protection of our environment; it is therefore right that your contributors should draw attention to all that threatens the quality of life on Earth. It is also essential, however, that you should be aware that many readers, like myself, while sharing your concern over crucial issues, have not had a scientific education and could be easily duped into adopting a false stand-point by such apparently irresponsible writing as appears in the article on SST's.

I would first criticise the way in which the "scenario" from the Sierra Club Bulletin was quoted—i.e. pointedly without comment or qualification. By continuing the article with the words "It may be added to this..." the author implies that the whole content of the "scenario" should be taken as read. Incredibly, no examination of the designers' and operators' explanation or defence is offered. The surely unfair suggestion has thus been made, insidiously and not in plain words, that the designers and operators of Concorde and other SST projects are ignoring or withholding information for the purpose of safeguarding their own interests. I am here referring to the flight problems touched on in the "scenario", not the environmental problems referred to in the last column of the article. If, as it is safe to assume, the development teams are aware of and concerned about these flight problems, they are presumably studying ways of overcoming them. If not, can Liedloff prove it? And if so, why does she not give them credit for it?

With regard to the noise problem, the mind boggles at the imaginary sound of 25,000 jets, even quiet ones, taking off together. No explanation is offered for this



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remarkable figure and, worse, while acceptable noise levels are quoted, no mention is made of the actual noise level of current heavy jets on landing approach or at take off. Consequently, the reader to whom the figure of 108 EPNdB means nothing, has no point of comparison when confronted with the important figure of 124 PBdB, save the 90 PNdB for fast lorries at the roadside. As people don't, as a rule, stand beside runways or float within feet of an aircraft's passage, the latter figure is not especially helpful. I would even question, tentatively, the validity of the figure of 124 PNdB, since I have learned from other papers that Concorde was fitted this summer with adjustable engine air-intakes, while Liedloff quotes from "Aerospace Technology" (how recent an issue, I wonder?) that the "engine inlets cannot be choked"—this being given as a reason for high noise level on landing approach. In addition, BAC have recently (since the publication of this article) stated publicly that production versions of Concorde will be far quieter than existing prototypes.

Even though it is plain that SST's will be a cause of environmental deterioration, I hope that the above points can be satisfactorily answered by Jean Liedloff, particularly because her article is basically a valuable one and because *The Ecologist* is a valuable magazine which must stand or fall by the complete integrity of its contributors. I fear that the parts of her article which I have discussed may constitute a type of scare-mongering which, slipped in beside *bona fide* material, could be more effective than it deserves to be. I hope my fears may be proved groundless by a *convincing* reply.

Yours sincerely,

A. T. Cooke.
 Charterhouse, Godalming.

Radio Ecology?

Sir,

It is becoming clear to many that the human species has reached such a stage in its scientific and technical evolution, and has harnessed such a vast amount of energy, that, unless man's very nature and mode of existence are transformed into something entirely different to that of the past or present, he is doomed either to extinction or to a kind of living death.

If his transformation is to take place it must be preceded by an awareness of what is happening to homo sapiens. *The Ecologist* is helping to give people this awareness. But greater use must be made of the mass media if more people are to face and discuss the fundamental problems confronting mankind, and I would suggest the setting up of a radio station (Radio Ecologist?) specifically for this purpose. Anyone interested?

Yours sincerely,

John Sears.
 392 Wisden Road, Stevenage, Hertfordshire.

Dutch needs double?

Sir,

I wish *The Ecologist* should be read by everybody. If ever you decide to publish it in another language, I hope it will be in the Dutch language, because all modern horrors seem to be worst here. And so *The Ecologist* is most needed here.

Yours sincerely,

Mrs M Veldhuyzen.
 Beukenlaan 7, Holland.

New Drugs for Old—Zinc Bacitracin

Sir,

Zinc Bacitracin may or may not be all the manufacturers claim it is but the fact remains that Zinc (a mineral element) is toxic.

Pigs, and indeed all animals including the human variety can assimilate very small quantities without harmful results, one could say with advantageous results, but if the very minute quantity needed is exceeded it has a very toxic effect.

So far as I have been able to ascertain no cases of a zinc deficiency have ever been found amongst animals that are kept under normal healthy conditions but trouble has arisen when, as stated above, the very small amount needed has been exceeded. All of which prompts me to ask Why feed Zinc? If I know and appreciate the toxicity of it then obviously the manufacturing chemists know this too and one would suppose in far greater detail.

Yours sincerely,

J. Fitzhughs.
 The Cairn, Broughton Park,
 Shoreditch, Taunton, Somerset.

Coming events

12 January—Lecture "The basis of conservation" and film "Food or famine". 6.15–8.45 p.m. at North East London Polytechnic, West Ham Precinct (room 33), Romford Road, London E15. Information from M. C. Boulter, B.Sc., A.L.S. (address as above).

19 January—Lecture "The effect on wild life" and film "Forest heritage". 6.15–8.45 p.m. at North East London Polytechnic.

26 January—Lecture "Pollution of land, air and water" and film "Desert green". 6.15–8.45 p.m. at North East London Polytechnic.

Classified Adverts

IDEAS GIRL seeks information about administrative work in conservation after graduating next June. Will have secretarial qualifications. Miss C. Clark, Newnham College, Cambridge.

WOMAN writer/speaker/sub-editor seeks work relating to conservation, organic farming, town-and-country planning etc. Ex-teacher of science, mathematics and English, editorial experience, fluent French and German. 40s. Offers or information to *The Ecologist*.

WILL PAUL the Carpenter of Kingston-on-Thames please contact *The Ecologist*, 73 Kew Green, Richmond.

FED UP with civilisation? South American anthropological expedition requires male paying participants to leave almost immediately for five or six months. Ring 01-711 0932.

In the next issue of The Ecologist

Inflation and Population by W M S Russell. Throughout our history there has been a close correlation between inflation and economic growth.

The Pesticide Fallacy by Roy Bridger. The very principle of waging war against 'pests' is challenged.

Ahead of their Time by G. N. Syer. An account of the life and work of two far-seeing Victorian conservationists.

Open Letter to the N.F.U. by Michael Allaby. British farming faces problems that can be solved only by reviving the principles of good husbandry. What is the NFU doing about it?

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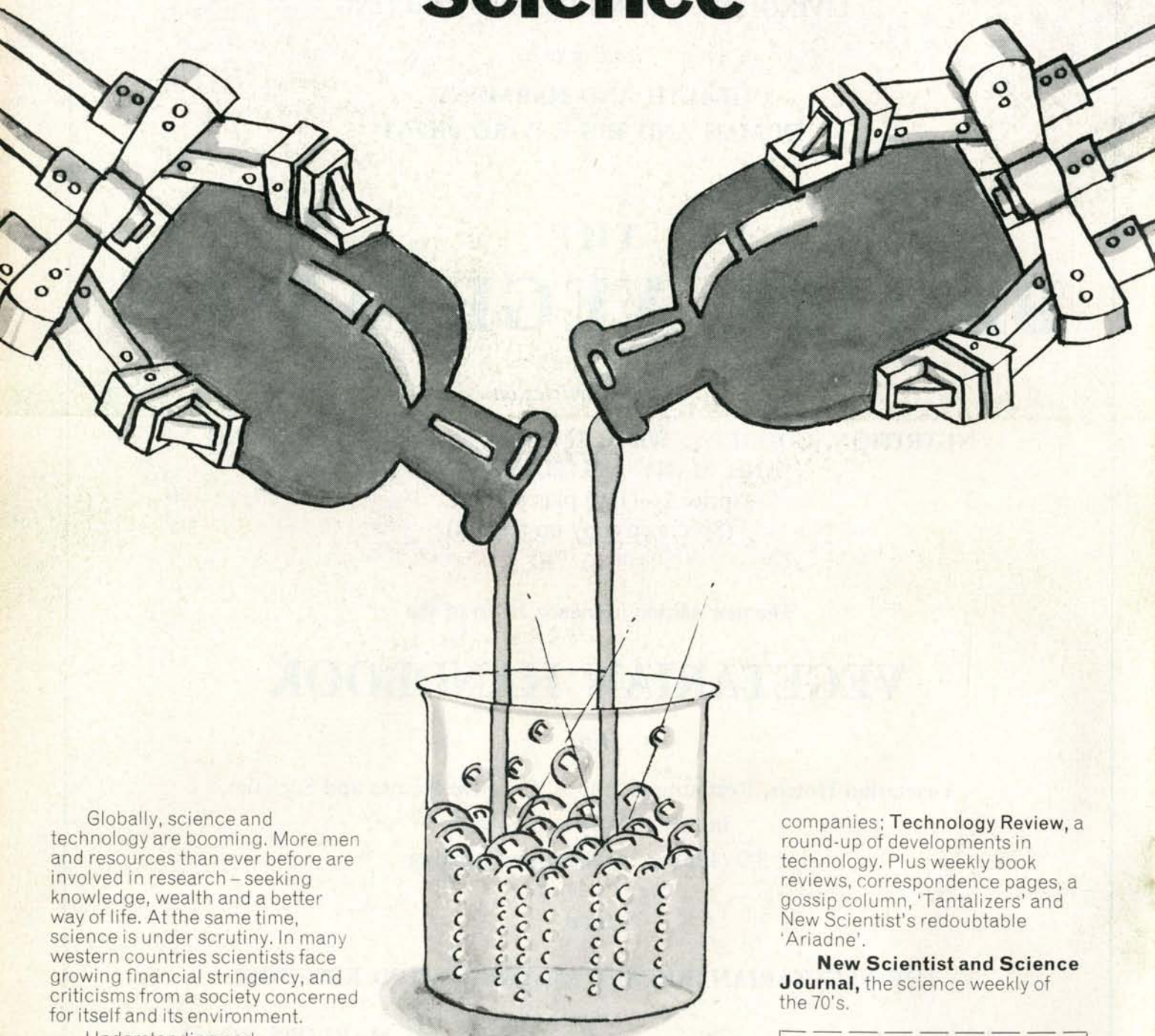
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