PHILOSOPHICAL TRANSACTIONS OF THE ROYAL SOCIETY B BIOLOGICAL SCIENCES

Domestication and Social Evolution

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Domestication and social evolution

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The centrality of agriculture as a field of research is witnessed by the number of interests represented in both the Royal Society and the British Academy which converge upon it. The methods by which human societies acquire food can be considered as components of systems which comprehend habitats, biomes, technology and the several dimensions of social and intellectual life. Such systems persist until the cost of maintaining them exceeds the benefit gained by so doing. The replacement of one system by another may be both drastic and rapid. The transition from hunting and gathering to farming may appear at centres of innovation to have been discernible only in quantitative terms, yet provoke social transformations of a qualitative and indeed revolutionary character. In domesticating animals and plants man had necessarily to domesticate himself. Social structures are conditioned by but also constrain methods of securing and distributing food. Similarly habitats and biomes constrain, but in the course of social evolution are increasingly shaped by modes of subsistence.

In their preface to the volume issuing from the first joint discussion meeting in the present series Lord Blackett and Sir Kenneth Wheare emphasized that 'The range of knowledge and research remains, as it has always done, continuous'. It would be hard to find a topic to which this applies more aptly than to the one down for discussion over the next two days. Agriculture occupies a key position. Its fruitful study – and for that matter its most profitable pursuit – depends on combinations of disciplines drawn from both camps. It calls for a synthesis of natural scientific and humanistic insights and techniques. Furthermore it enshrines a truth we ought never to forget, namely that the acceptance of research and so in the long run its success, depends on reconciling the exploration and manipulation of natural forces with the nature and aspirations of men.

One way of making clear the centrality of agriculture is to identify the main fields of study within our two bodies which converge upon it. To take first the Royal Society. The physical sciences bearing most directly on the habitat discussed by Professor Dimbleby all fall within the purview of a single section (table 1). Those bearing on different aspects of the biome on the other hand involve, though to a markedly varying degree, disciplines grouped under each of the six sectional committees which together form the biological sciences (table 2). We shall be hearing Dr Pickersgill on genetics, Professor Jope on biophysics, Professor van Zeist and Dr Evans on palaeobotany, Mr Jarman on palaeozoology and animal husbandry and Professor Harlan on the problem of domestication as a whole.

No doubt it was partly because of the range of interests served that the Early History of Agriculture Project was the first to be adopted by the British Academy under the policy adumbrated by Lord Robbins in his Presidential Address for 1965. It is no wonder that it should have emanated from the archaeology section, since so large a proportion of the material data recovered by excavations relates to people who supported themselves by means of farming. But the importance of investigating the economic and in the first instance the

subsistence base of human societies (table 3), as a means of understanding how they functioned and why they were structured in the way they were, applies not merely to the prehistoric communities among whom farming first developed, but to all societies which obtained their food substantially from agriculture. The history of agriculture is important not merely for archaeologists, but for historians, economists, anthropologists and all those concerned with the socio-cultural dimension of human affairs, not excluding literature and the arts.

TABLE 1. THE MAIN FIELDS OF STUDY BEARING ON THE HABITAT OF EARLY FARMERS WITHIN THE SCOPE OF SECTIONAL COMMITTEE 5 OF THE ROYAL SOCIETY

Royal Society; physical sciences
5
meteorology; hydrology geology; physical geography geochemistry; soil physics
habitat

TABLE 2. THE MAIN FIELDS OF INTEREST BEARING ON THE BIOME OF EARLY FARMERS WITHIN THE SCOPE OF SECTIONAL COMMITTEES 6–11 OF THE ROYAL SOCIETY

Royal Society: biological sciences		
	11 genetics	
8 biochemistry nuclear biophysics	9 nutrition	10 medical sciences demography
6 plant anatomy, taxonomy, breeding and ecology; palaeobotany		7 animal anatomy, taxonomy and ecology; zoology; palaeozoology
biome		

TABLE 3. THE SECTIONS OF THE BRITISH ACADEMY BEARING MOST DIRECTLY ON THE SOCIAL DIMENSION OF EARLY AGRICULTURAL SYSTEMS

British Academy sections	
9 economics and economic history	12 social and political studies
2 mediaeval history	
1 ancient history	4 Oriental and African studies
10 archaeology	
society	

The study of the early history of agriculture not merely requires the attention of many disciplines from both sides of the fence between the arts and sciences (figure 1). Above all these have to be brought to bear in an ecological context. The relations of the various disciplines are a mirror image of the way in which human societies themselves function in their natural settings. We need to think of them in terms of systems, systems constituted by the reciprocal interaction of a variety of physical, biological and socio-cultural forces. Each system is to a

degree unique (figure 2). The great civilizations of mankind were each based on varieties of farming, but the species of animal and plant domesticated, the relative importance of animals and plants, the degree of fixity of settlement and many other factors varied within wide limits. It is right that we should hear in this meeting about the type of farming with which most of us are familiar in the west. We look forward to hearing from Professor Harlan and Professor van

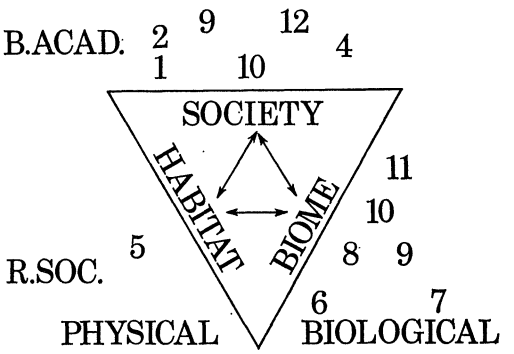

FIGURE 1. Diagram illustrating the sectional committees of the Royal Society and the British Academy most relevant to an understanding of ecosystems comprehending agriculture.

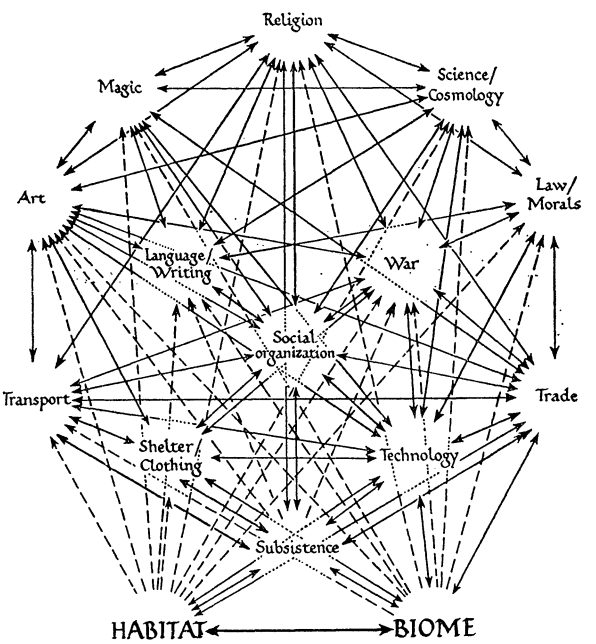

FIGURE 2. Diagram illustrating some of the interactions between different aspects of the socio-cultural component of ecosystems comprehending agriculture.

Zeist about the formative stages in southwest Asia and no less from Mr Higgs, the Jarmans and Mr Boardman about the varying forms of husbandry practised in different parts of Europe. On the other hand contributions such as those by Dr Bushnell on Mesoamerica, by Sir Joseph Hutchinson on the crops of India and from Dr Chang on the rice cultures, which today support so large a part of the world's population, should help us to appreciate that wheat and barley and the range of domesticated animals familiar in the west are only a small part of the story. Time alone restricts us to only a few of the numerous systems devised by mankind.

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Another reason why I have emphasized the partnership between the humanities and the natural sciences in the study of agriculture is that its practice, which we recognize as a necessary foundation of societies capable of formulating abstract scientific theories, implies at least an empirical knowledge of science based ultimately on observation. In a recent issue of *Daedalus* (Summer 1974, p. 83) André and Jean Mayer went so far as to claim that: 'When human beings first learned the cycle of plants and seeds, they were scientists. As they learned when and how to plant, in what soil, and how much water each crop needed, they were extending their understanding of nature. This knowledge was not less scientific for having been discovered and transmitted by people who could not read or write. No scientist performs a greater act of faith in the predictability of the operation of natural laws than the farmer who plows a part of this year's harvest back into the earth.'

If peasants are to be accounted scientists by virtue of apprehending natural forces well enough to be able to manipulate them for predictable ends, what of reindeer? Do these not display intense dietary discrimination, exploit their environments effectively and by the way in which they regulate their seasonal movements evince a capacity for successful prediction? But we are not here to discuss the differences between genetically and socially acquired behavioural patterns. Two things only need to be said:

(1) By contrast with other animals men employ a more or less complex material apparatus of their own making to aid them in the acquisition and processing of food, apparatus which involves both technical know-how and social organization for effective deployment. Professor Steensberg's contribution will illustrate this in respect of tillage.

(2) Whereas mammals, if we exclude parent/young relationships and the symbiotic relationships established between members of certain species, are self-sufficient units, 'a large proportion of a man's energy expenditure' to quote Richard B. Lee in respect of Bushmen 'goes to feeding others, and a large percentage of an individual's consumption is of food produced by others'. The social structure of primitive societies is directed as much to distributing as to securing food.

The fact that Lee based his observations on Bushmen reminds us of something which has emerged strikingly from the work of the Cambridge Unit of the Early History of Agriculture Project, notably in that of Mike Jarman and Eric Higgs, namely that the same fundamental regularities underlie the food quest of human societies whether these are classified as hunter/foragers or agriculturalists. Semantic considerations have helped to obscure this truth. Words like crop, harvest or husbandry are so closely linked in our minds with the agricultural basis of our own society that we are only too prone to overlook the fact that human societies of whatever kind depend for their subsistence, directly or indirectly, on cropping, harvesting, and husbanding animals and plants. The viability of any society rests upon its success in feeding its members. Under primitive conditions this in turn depends directly on knowledge of the distribution, habits, life cycles and properties of available animals and plants, on the technical means available for exploiting these, on the social mechanisms involved in the quest for food and in its distribution and not least on the ideology that ensures the coherence of society and a correct balance between population and food supplies. The convention by which economies based on such activities as foraging and hunting are considered to be merely predatory, whereas those based on farming are held to be productive in a sense begs the question. Both systematically exploit natural resources. If they do so at different intensities, this is mainly because they are attuned to supporting human populations at different densities and standards of social life.

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From a historical point of view indeed the essential difference between hunter/foragers and farmers resides precisely in the much greater potential in respect of both population density and social development of societies whose economies are based substantially on domesticated animals and plants. Whereas no society restricted to exploiting the natural increase of animals and plants living under wild conditions could enhance its efficiency more than marginally, farming, as we can see with the benefit of hindsight, held the promise of a continuing expansion of yields and so of population. The process of domestication entailed the creation of an artificial, that is of a man-made environment in which animals and plants were protected from predators (other than man himself) and advantaged in relation to competitors. It also implied that the preferred animals and plants were raised and tended in the more or less immediate area of the homestead (as the term domestication itself suggests). On the other hand where conditions favoured pastoralism stock might be grazed over annual territories as extensive as those required for some hunter/forager economies. In so far as effective control over breeding could be established domesticated animals and plants became sexually isolated and this, together with the differing conditions under which livestock were maintained, may well explain why in course of time many species diverged genetically from their wild prototypes sufficiently to be readily distinguished among the refuse found on early settlements.

It follows from the premise that human societies are components of interacting systems which comprehend habitat, biome and all the several dimensions of economic, social and intellectual life, that a change in the relationship between men, animals and plants as fundamental as that implied by domestication was bound in the long run to entail changes of a thoroughgoing nature in the socio-cultural dimension, whether in respect of settlement, population, technology, social structure or ideology. Gordon Childe summed these up by claiming that together they constituted a veritable 'Neolithic revolution'. In what respect was he justified in speaking in such terms? Let me emphasize at the outset that no one has effectively denied that the domestication of animals and plants was revolutionary in its implications. No society we could term civilized has ever developed on any other basis. The debate centres only on how far the change was revolutionary in the sense of being catastrophic and sudden. The answer as with so many questions depends on one's point of view.

To anyone concentrating on the food refuse from prehistoric settlements there can be no question that the process was gradual and long drawn out. This can be seen with special clarity in the case of plants in the remarkable sequence obtained from the Valley of Mexico by R. S. MacNeish described by Dr Bushnell or, again, in the progressive intensification of methods of cultivating rice described by Dr Chang. The differences between foraging and reliance on fully domesticated and elaborately cultivated plants may be obvious enough, but the transition may extend over thousands of years and be barely perceptible in the short term. The process can as a rule only be broken down into phases by statistical means in much the same way as the development of forest history has been by pollen-analysis.

To anyone more concerned with the socio-cultural outcome of changes in the pattern of subsistence things do not always appear in the same light. Admittedly the archaeological record when studied in quantitative terms is often found to reveal a much more gradual process of change than that which appears when more subjective methods are used. Even so there are occasions, even if much rarer than appeared in an earlier stage of archaeological research, when abrupt changes appear to have occurred. To understand why socio-cultural systems were able to maintain coherence and form in the face of changes in the pattern of subsistence over

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long periods of time and then at infrequent intervals undergo more or less marked and rapid periods of readjustment it may be helpful to bring into play the principle of homeostasis. According to this, any system, whether this be a body or a social order, responds to threats by drawing on its own resources. It is only when a critical threshold has been passed that systems break down. Just as when vital organs cease to function the body dies and disintegrates, so when pressures and contradictions build up in a society to a point at which the cost of maintaining the *status quo* exceeds the advantages of doing so, one social pattern or system gives place to another better adapted to existing circumstances. If we adopt this model we might expect archaeologists, who deal after all with no more than the material detritus of former states of society, to reveal well defined faults in their stratigraphic sequences, faults coinciding with crises when one system gave place to another. It was his recognition of these in the archaeological sequences of different parts of southwest Asia that led Gordon Childe to formulate his concept of the Neolithic revolution. If we allow for the time lag inherent in the homeostatic process, there is no essential contradiction between regarding domestication as a long drawn out and barely perceptible transition and accepting that under certain conditions consequential social changes might appear as comparatively sudden.

The question must next be faced why this process unfolded apparently independently in different parts of the world and why farming and its correlates spread from such innovating centres over extensive territories until they reached their ecological limits. After all people like the aborigines of Cape York, so lovingly recorded by Donald Thomson, or the Eskimos o Hamilton Inlet, Labrador, observed by Fitzhugh, maintained self-regulating and socially fulfilling systems with a minimum of equipment solely by appropriating the natural increase of animals and plants. And such people, like their analogues in Ice Age Europe, had leisure for ceremonial, ritual and artistic activities of some complexity. A point to be emphasized is that all this was accomplished on a low input of work. Richard Lee's observation of Bushmen with similarly limited technology is that they satisfied their needs on the equivalent of a $2\frac{1}{2}$ day week. By contrast farming involved heavy burdens, markedly greater input of technology and hard labour to produce supplies of food which, if more assured, had to be shared among larger numbers. Professor Wolf Herre expressed it mildly in relation to livestock when he wrote that to offset its many advantages, 'with domestication man took on responsibilities as well.... The more man aims at [this] higher quality in his domestic animals, the greater the attention they must receive, so that man becomes the servant of his animals. A remarkable psychological adjustment was necessary to bring this about, entailing a readjustment of social structure.' Agriculture was even more onerous. Wholesale forest-clearance, land-terracing and irrigation are only a few of the calls made by different environments. The blunt fact is that the process of domestication involved man himself quite as much as his animals and plants. The milk-stool and the mattock were forerunners of the conveyor-belt and the punch-card. When Adam ate that apple he did so not from hunger but from a desire to know. We can only understand domestication if we remember that foragers were scientists too. Farming was one fruit of their experiments.

It is hardly necessary to look beyond Darwin's insight to account for the widespread acceptance where ecological conditions were appropriate of innovations which improved the quality and bulk of food supplies and at the same time made them more accessible and more certain, even if for individuals they imposed a more irksome discipline. The adaptive value, from a social viewpoint of a more reliable subsistence base, more especially when muscled by a more effective

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technology, requires no emphasis. As to the mechanism by which farming economies spread widely over territories peripheral to the main centres of innovation, I would remind you that ecosystems only exist as isolates for purposes of analysis. In reality the existence of other systems and not necessarily only proximate ones is an ever-present factor in the environment of any one of them. In the case of systems including men the need to adapt to ideas derived from elsewhere must always have been a factor in promoting radical change at critical times. It is a matter of observation that farming made its appearance in peripheral regions in new socio-cultural settings conventionally termed 'Neolithic'. On the other hand new systems might be expected to expand only so far as they proved more effective than older ones based on foraging and hunting. In northern Europe for example farming expanded only marginally beyond the temperate zone in early times. Further north and locally even within the temperate zone food was most economically obtained by foraging, fishing and trapping.

What I have sought to emphasize in this opening talk is that modes of subsistence and in particular the methods used to exploit animal and plant resources form so to speak a hinge between human societies and their physical and biological environments. That is why they can only be understood in terms of systems comprehending human societies and by means of humanistic as well as natural scientific disciplines. The very structure of societies depends upon and constrains methods of securing food. These in turn are both constrained by but increasingly in the course of social evolution have come to mould the various habitats and biomes occupied by men.

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