

## THE PROBLEMS AND PROSPECTS OF CULTURAL EVOLUTION

Robert Fellner Institute of Archaeology

### Acknowledgments

I would like to acknowledge with gratitude the support I have received in writing this paper. The manuscript was read by Prof. R.Hodson, Dr. A.Stahl, B.Fleury and K.Basa, among others. Their constructive criticisms have been much appreciated. My fellow students at the Institute of Archaeology, London, have given me the opportunity of formulating my ideas by being willing participants in numerous discussions, and by correcting at least some of my errors. It should, of course, be added that I alone am responsible for the views expressed here, views with which those who read the manuscript may well disagree

### Introduction

Archaeological interpretations of change in prehistoric cultures usually refer to a specific view of why and how cultures change or evolve, a view which is often established in the researcher's mind before the actual research begins, and which might easily shape both research design and the interpretation of the resulting data. If, for instance, we looked at recent publications interpreting Palaeolithic sites and cultures, we would observe frequent reference to such concepts as 'adaptation' and 'optimization'; research would be found to be designed for obtaining data considered relevant to these concepts - environmental and settlement pattern reconstruction might be primary goals. It is however quite rare to find actual explicit discussions of the underlying assumptions; for while the principles and problems of cultural evolution have frequently been a subject of discussion among theoretical archaeologists and anthropologists, these deliberations seem to have had little direct impact on their practising colleagues. This paper is designed to provide a short and hopefully clear account of the said principles and problems. None of the points made here are truly original, though perhaps assembled in a novel fashion; it is hoped, however, that in discussing most of the relevant questions in as short a space as possible, this may help in bridging the communications gap that has been the result of the somewhat too rarefied atmosphere of pure theoretical discussion on the one hand, and a certain lack of interest among practitioners on the other.

### Two kinds of cultural evolution

Since the middle of the nineteenth century, cultural evolution has been a very popular word in archaeology and sociocultural anthropology. Different people have meant different things by it; but the large variation in meaning that resulted can be assigned to two broad concepts: the *Spencerian* and the *Darwinian* models of cultural evolution (Ingold, 1986, Ch. 1). Spencerian cultural evolution is the older, and perhaps more popular version. Its historical roots go back as far as the 18th century (Harris, 1969, 27-31). It was thoroughly defined by Herbert Spencer from the 1850's onward (Harris, 1969, 123-129) and soon found a number of prominent adherents in anthropology and archaeology: L.H.Morgan (1877), E. Tylor (1871), F.Engels (1954), V.Gordon Childe (1951) and - more recently - L.White (1949) and J.Steward (1955), to name but the best known. It views society as evolving through well-defined stages, progressing from chaos to order, from simple to complex, from

'lower' to 'higher'. The theory was developed from two sets of empirical observations: the archaeological and the ethnographic records. The archaeological data show quite clearly that technologically simple cultures ultimately preceded more complex successors; this 'progress' is observable, in an overall view, from the Oldowan stone tools to the space-age technology of today. Ethnographic observation showed a range of societies which were, to a varying extent, considered more 'primitive' than modern Western civilisation. These societies were seen as survivors of earlier stages of cultural evolution. They furnished data on ideological, political and social life that could not be found in the archaeological record, and were used to define these aspects of the various stages. The Spencerian model is based on the following axioms:

- cultural evolution is progressive, inevitably advancing from a less complex, 'primitive', to a more complex, 'civilized' state. The process has thus a definite direction, and can be characterized as teleological or goal-oriented.
- all cultures pass, during their evolution, either through the same broad stages (the unilinear view) or through similar alternatives (the multilinear view).
- the cultures which belong to a particular stage share a set of basic characteristics which describe the economy and technology as well as the social, political and ideological life: the techno-economic 'base' is solidly linked to the socio-ideological 'superstructure', either determining it or being determined by it (various schools differ on this question). This principle allows the assumption that ethnographically known societies are, on a gross level, identical to prehistoric cultures with a similar techno-economic base. It is thus the foundation of the 'comparative method'.
- the rate of cultural evolution is seen as extremely uneven. Cultures remain essentially unchanged while on a certain stage; they will go through a *revolutionary* or very rapid change to reach the next stage. We can imagine Spencerian evolution as a stairway, where the vertical dimension stands for progress, the steps are the various stages, arranged in order of their relative complexity and the risers are the revolutions a culture must pass through to advance from one stage to the next, such as the agricultural revolution, the urban revolution, the industrial revolution, etc.

The mechanisms which are used to explain Spencerian evolution vary from one school to the next. Generally it is assumed that cultures are conservative and passive, and will rest on a given stage as long as possible. Some sort of external or internal pressure has to be invoked in order to explain the revolutions which propel cultures from one stage to the next: population growth, environmental change, or internal contradictions are some of the more popular causal principles. To round off this short description of the Spencerian model we can make two further observations: it deals with cultures or groups as a whole and not with individuals; and it can, finally, be characterized as an *historical generalization* (Hempel, 1966, 54-58; Dunnell, 1980, 43) as opposed to a theory made up of a set of mechanisms or laws.

The other view of cultural evolution is ostensibly based on Darwin's evolutionary model as first expressed in *The Origin of Species* (Darwin, 1900) - as opposed to another model proposed by Darwin in *The Descent of Man* (Darwin, 1871). We are surely all familiar with the concept of Darwinian evolution in biology, but for the purposes of this article it might be useful to quickly review this theory.

Darwinian evolution can be broadly divided into two main concepts: *variation* in reproduction and natural *selection*. Darwin observed that when living organisms reproduce, the offspring are (often) not identical to the parent(s). While not understanding the real mechanisms of reproduction (i.e. genetics), Darwin correctly deduced that the differences between offspring and parent were 'accidental' or 'random' occurrences: they were not influenced by the actions of the parent or by environmental circumstances. We now know that variation is caused by changes within the genetic material, due either to 'miscopying' or to mutation.

Once variation in reproduction has taken place, the second and *independent* mechanism of natural selection begins to operate. The effect of the variation of traits in an organism can - in relation to the external environment - be considered as either harmful, neutral or advantageous. If it is harmful, i.e. if the offspring is less able to survive in and cope with its environment as a result of the variation, it would be less likely to get a chance at reproduction, and thus the harmful trait would be less likely to be passed on to the next generation. Through time, the trait would disappear completely as a result of this 'differential reproduction'. If the trait is neutral, the chance for reproduction would remain unchanged - natural selection would not operate on this trait, and its ultimate spread or extinction would be determined by other traits occurring in the same organisms. If the varied trait is advantageous, the organism possessing it would get a better chance at reproduction than the same organisms without it. Natural selection, then, is the pressure of the outside environment operating on individual organisms and, indirectly, on the variation of inborn traits. We can see that the organisms themselves cannot affect the outcome, as, by the time they are born, the traits which will be selected for or against by natural selection are already established. To contrast Darwinian evolution to its Spencerian counterpart, we can characterize it with following statements:

- Darwinian evolution does not predict a particular direction in which the outcome must lie; it is thus not teleological or goal oriented.
- the Darwinian theory is made up of a set of interlinked laws or mechanisms. It is not a historical generalization, but an explanatory framework.
- it operates at the level of the individual organism, not at that of the group.
- evolutionary change is seen as constantly occurring, although many biologists now believe that its frequency is variable (Gould, 1980, 149-154). It cannot be characterized as revolutionary or transformational.

Socio-cultural anthropologists and archaeologists have tried to apply the Darwinian theory to cultural change in various ways. Some have simply transferred the model by claiming exact equivalence between cultural and biological mechanisms and classes (Bray, 1973; Bergerhoff-Mulder, 1987). Others have identified differences between the two domains, but retained the basic principles of Darwinian evolution in their model of cultural change (Rindos, 1985, 1987; Durham, 1976; Dunnell, 1980).

#### **A critique of the Spencerian view**

In the preceding section of this paper I have attempted to demonstrate that "Spencerian" and "Darwinian" evolution are very different. Consequently, the success of the Darwinian paradigm in explaining biological evolution cannot be taken as a

testimony for the efficacy of Spencerian theory in dealing with cultural change, as has often been assumed in the past (Childe, 1951, 166). We have also seen that among the proponents or supporters of Spencerian evolution, no unanimous agreement on the actual mechanisms driving it has been reached.

Indeed, all of the principles invoked - dialectical materialism, environmental determinism, Malthusian determinism, etc. - can be said to be rather controversial. In the absence of an adequate explanation for the increase of complexity through time observed in the archaeological record, Spencerian thinkers have resorted to declaring progress to be inevitable, a 'law' of culture (Spencer quoted in Harris, 1969, 125). Pointing to biological evolution as well as to 'culture history', they have argued that the simple form has temporal primacy over the complex, which gradually replaces it; progress, so they conclude, is inherent in the life-process itself. Few biologists would readily agree with this view. Undoubtedly, simple organisms do appear earlier than complex ones in the history of life; yet this is not the effect of an underlying progressive principle, but is rather the outcome of a *developmental history* resulting from the operation of the Darwinian mechanisms. Any variation in the genetic makeup of an organism has to build on whatever is there in the first place. As far as complexity is concerned, such a change can go in three possible directions: the genetic 'blueprint' can become simpler, it can stay at the same level of complexity, or it can become more complex. The actual success of a variation is not determined by this aspect of the event, but by natural selection. However, if we imagine a large number of such trials, it is reasonable to suppose that some of the variations tending towards increased complexity will be successful. They, in turn, form the basis of future variations, some of which will again be more complex, etc. Thus, complex forms, while (due to their necessary developmental history) appearing later than simple ones, do not a priori replace them; they only do so if they are more successful under natural selection. Observation of nature shows us that this is often not the case. The relatively simple organisms are much more numerous and widespread than the more complex ones. Insects are very successful; apes, on the other hand, are much less so: their distribution and numerical strength is very limited. The concept of progress implies that later, more complex forms are 'superior' to or more successful than earlier, simpler ones. As in biological evolution success is equivalent to survival, and as complex forms are not inherently better able to survive than simple ones, we must conclude that no progressive principle can be seen at work in nature.

Is it then found in cultural evolution? The archaeological and historical records do indeed show that not only do complex societies appear later than simpler ones - this being again, it could be argued, a result of developmental history, as new ideas, like new genetic combinations, can only be derived from what is already present (Bronowski, 1973, 20) - they actually seem to replace them. Bronze age cultures did, in general, replace Neolithic ones, and were in turn superseded by more complex Iron age societies, etc. In this sense then, a progress from simple to complex does seem to occur in cultural evolution. However, *progress is not a universal principle*, as we have seen; if it applies to cultural but not to biological evolution, then we do have to find an adequate explanation of why and how it works. As mentioned above, no really convincing mechanism which would account for this observed progress has been proposed by Spencerian theorists; without it, their view of cultural development remains purely descriptive and without any explanatory value.

What then of the idea that evolution is divided into stages, and the implied extremely erratic rate of change? A close examination of the archaeological record does not seem to support the view that the developmental path of cultures follows an orderly set of stages, separated by sharp boundaries. The only comparable stages found in prehistory are those large segments of the archaeological record usually called 'ages': the Iron age, the Bronze age, the Neolithic, the Palaeolithic, etc. Any practising archaeologist will readily admit that these units are far from monolithic; they cover wide ranges of complexity and the boundaries between them are usually very diffuse or even artificially imposed by the researcher. They do not, in the overwhelming number of cases, exhibit the sharp boundaries resulting from truly revolutionary change. It would thus seem that the Spencerian stages, and the implied two-speed (static or revolutionary) view of change, are the result of a gross oversimplification of the actual data. If we add to that the above mentioned absence of adequate explanatory mechanisms, we must conclude that Spencerian cultural evolution is, at the best, a very simplified view of cultural development; at the worst, it obscures the actual diversity of the data and is thus downright misleading.

#### Natural selection and independent variation in the cultural domain

While introducing the Darwinist school of cultural evolution I mentioned internal differences within it; indeed, these quite divergent views can only be unified under one heading because they all rest on the assumption that the mechanisms of Darwinian evolution - independent variation, natural selection, and resulting differential reproduction - are concepts of explanatory power in examining cultural development (Dunnell, 1980; Rindos, 1985). This assumption must be seriously questioned.

If we were to specify a counterpart to genetic variation in the cultural domain, we would surely refer to the appearance of new concepts inside the head of an individual. Concepts, like genes in biology, are the basic unit which lie behind any observable cultural change. We cannot, after all, construct a new tool without having first imagined it; for while chance events may in rare cases indeed lead to the discovery of unknown tool types, their recognition and subsequent exploitation demand nearly as much thought as if no 'outside' stimulus had occurred. If, for example, the discovery of metallurgy was made possible by the accidental juxtaposition of a lump of ore and a hot fire, its practical application - the creation of the first cast metal tool - still required a considerable number of conceptual steps. All conscious action - and it is consciousness which makes the difference between a culture (a group of socially interacting individuals) and a group of animals behaving instinctively - must be based on thought, or, in other words, concepts. So, conceptual variation can be likened to genetic variation. But it does not work in the same manner. In Darwinian evolution, variation has to be independent of natural selection. It is unaffected by the will of the individual or the outside environment. Conceptual variation is *not independent* from either cultural selection or the outside environment; it is subject to the will of the individual. We can easily imagine a situation where a concept or idea is prompted by an outside event to which it is a specific response (problem-solving); and conceptual variation is subject to individual will because the decision on whether the concept should be communicated to others or not (or indeed acted upon in any way) is not automatic, but has to be consciously made. The way in which the individual communicates the concept will, finally,

influence the selective process: conscious decisions on how and when to communicate will affect the reception of the concept by others.

Variation in the cultural domain seems thus very different from genetic variation. What then of the *selective process*? To recapitulate: natural selection can be defined as the result of the struggle for survival among all living creatures. An individual organism is born into an environment where resources are relatively scarce and the object of competition. The organisms' structure and behavioural pattern are determined by its genes before its birth. The success of the organism - its continued survival until it can reproduce - depends on how well its in-born abilities stand up in competition with other organisms and in relation to the non-organic environment.

Natural selection is thus clearly placed *outside* the individual organism, and is not subject to any choice made by it. If we examine how concepts are selected in the cultural domain, we can immediately see some major differences to the Darwinian mechanism (Burnham, 1973; Ingold, 1986, 64). Most striking is perhaps the apparent complexity of cultural selection. Unlike the relatively simple process of natural selection, cultural selection can be divided into at least three separate but interlinked stages. In *internal selection*, the self-conscious individual makes the decision whether or not to communicate the invented or inherited concept (see above). The manner in which the communication will be made will influence the next stage, which we may call *group selection*. Here, the group of individuals, to whom the 'concept originator' is affiliated, have to decide whether they accept or reject the concept, and to what extent they do so. The efficiency or practicability of the concept - a criterion similar to those of natural selection - will be only one of many criteria, such as the social position and history of the 'concept-originator', the compatibility of the new concept with already established ones, etc. Leonardo da Vinci, for instance, is known to have invented a number of machines which might well have been of practical use at the time: a primitive submarine, a simple machine-gun, etc. His contemporaries dismissed these ideas as fantastic; the group rejected the new concepts. If the concept is accepted by the group, and acted upon, the extent of group commitment (are all group members committed? what is the relative strength of the commitment as compared to others?) will affect the next stage, which we could label *environmental selection*. This could be described as the practical testing of the concept against the social and natural environments. Let us, for instance, imagine that a member of a desert tribe conceives of building a fortification of sand instead of stone, the former being much easier to procure. He convinces the other members of his group that his new idea is valid and should be tried out. The fortification is built. During the next storm, however, the sandy ramparts collapse, perhaps burying some of those they were built to protect. A sand-castle is useless in areas where high winds occur; the concept has been selected against by the environment.

Another important difference to the Darwinian mechanism is the flexibility of cultural selection. Genetic variation and natural selection are *irreversible*. The individual organism cannot abandon, reverse or modify the effects of genetic variation. If the individual has a harmful variant, it will undoubtedly die as a result of natural selection. Conceptual variation and cultural selection are, in contrast, reversible. The individual can abandon, reverse or modify inherited or created variation. Selection has no necessarily fatal effects, as harmful variants can be changed or abandoned.

Finally, we can point to the role of *commitment* in cultural selection. In Darwinian evolution, an organism either has a certain variant, or it doesn't; there are no intermediate possibilities. In cultural evolution, the commitment the individual has towards a concept can vary, and this variation will affect the outcome of the selective process. Let us, for example, imagine that an individual has the concept of a bow and wishes to act on it. If the individual is but slightly committed to the concept, it will expend a minimum of effort in producing the bow; the product may only be half-finished, or of inferior quality. If the same individual were highly committed to the concept, it would expend more effort in producing the bow; the product will be as carefully finished as is possible. Thus, commitment will influence the success of the concept: the half-finished bow is very likely less useful than the carefully made one.

Summing up the argument, it seems clear that the mechanisms of cultural change must be very different from those of Darwinian evolution: variation and selection are not independent; selection can be divided up into several interlinked processes, all of which can presumably feed back into the variation process; outcomes are reversible; etc.. We must therefore conclude that the Darwinian model cannot, in any meaningful way, be applied to cultural development.

In the last two decades, many archaeological interpretations have rested on models borrowed from biology. One may think in particular of the "cultural ecology" school (Rappaport, 1977; Kirch, 1980; Flannery, 1969) or of "optimal foraging theory" (Smith, 1983). Ecological theory, developed by biologists, is of course linked to biological views of change, i.e. Darwinian evolution (Keene, 1983). The concept of *adaptation*, for instance, is used to describe the outcome of independent variation, natural selection and differential reproduction. Thus organisms with useful variations are more adaptive than the same organisms without them. If, as has been argued, the Darwinian model cannot be applied to cultural change, then the biological concept of adaptation cannot be useful either. Explaining cultural change by simply calling it an 'adaptation' in response to some outside stimulus treats people as basically passive and essentially powerless organisms who react instinctively to outside events. I have argued above that this is not the case. Cultural change must involve active decisions among participants; the concept of adaptation thus becomes misleading when applied to self-conscious subjects. This is not to say that people do not react to environmental change or that they do not use material culture to deal with it; obviously we do so, but this is not the only or even necessarily the prevalent reason for cultural change. *Cultural change can take place without outside pressure*; a stimulus-response model overlooks the decision-making capabilities of sentient actors (Whyte, 1977, 77).

### **Are there alternative models?**

So far I have concentrated on criticising the predominant explanations of cultural change without offering more satisfactory solutions. I freely admit that I cannot come up with an effective working model of cultural change, but I may at least point out some aspects of the problem which have recently received little attention from many archaeologists.

In the preceding section I have argued that the Darwinian model is inapplicable to the cultural domain because of the important differences between animal and human behaviour. Any workable model of cultural change has to account for these differences; it would also have to be made up of a set of mechanisms that can

serve as an explanatory framework, and do so convincingly. It seems to me that we are, as yet, far from such a framework; but we can at least examine some of the more striking differences between animal and human behaviour, and consider their implications.

Warfare - the planned conflict between two or more groups of individuals of the same species - is unique to humanity. Similar behaviour has been observed in some social insects (a few ant and termite species), with the important difference that in those cases only one real individual - the hive - and one reproductive unit - the queen - stands for each group. Therefore, human warfare is a very peculiar phenomenon and is in striking contrast to the behaviour of other animals. This is, however, only the most visible form of conflict; it could be argued that *conflict in general*, manifested either in open violence or - perhaps more frequently - channeled into trade, politics, and similar activities, suffuses both intra- and inter-group human behaviour to a larger extent than observed among any other animal species.

Another important difference between the cultural and the biological domain has been pointed out above: *complex cultures* frequently replace *simpler ones*.

These two characteristics of human behaviour may be linked, and can be tentatively explained, by reference to a third: the *self-consciousness* and *sentience* of humans. This is not the place for an extensive discussion of these concepts; short and perhaps simplistic definitions will therefore be used. By self-consciousness I mean the awareness of one's individuality in relation to the social and natural environment. Sentience can be defined as the extensive reliance on conscious, reflexive thought in dealing with the outside world. A self-conscious, sentient being has a perception of the world based on individual thought and experience. Much of this world view will be shared by individuals belonging to the same group, or culture, but not all of it, as individual thought and experience must always be unique. These differences between personal world views are certainly one important reason for conflict. The incomprehension of others that it can entail is presumably the motor driving such irrational behaviour as fanaticism, racism, religious war, etc.. On the other hand the awareness of one's social position implied by self-consciousness can also lead to conflict, through the desire (commonly called ambition) to better the perceived status, which can only be done by worsening that of someone else. This self-conscious ambition, unlike dominance behaviour in animals, is not restricted to the genetically prescribed path of instinct, but can lead to many courses of action, some of which may involve cultural change (Montagu, 1976, 308). Thus, the extraordinary importance of conflict in human behaviour could be the result of self-consciousness and sentience.

Looking at the other problem, we could argue that complex cultures may have replaced simpler ones because they are better able to handle conflict. A complex society has more mechanisms (such as laws etc.) to channel conflict into productive behaviour, or to prevent counterproductive behaviour arising from conflict. In case of conflict between rather than within societies, the complex culture may have the advantage over the simpler one through superior organisation, and the consequent ability of mobilizing larger amounts of resources.

This leads me to suspect that conflict plays an important role in cultural change, perhaps more so than changes in the environment or in demography. I have argued that all sentient individuals have their own, personal world view, based on their own thought and experience. This perception of the world must form the basis of



all decisions, and therefore of non-instinctive actions, including cultural change. Because it is made up of individual thought and experience, it is tied to the time-scale of human life. In other words, events which take place at timespans much longer than that of an individual life or (taking into account oral history) several lives, are perceived only with difficulty by sentient individuals (at least in prehistory). Changes in the natural environment or in demography are often very long-term events; if they are - because of their 'slowness' - imperceptible, they cannot form part of the individual worldview; if they are not integrated into the world view, they cannot be the basis of decisions. This is not to say that environmental and demographic changes never lead to cultural change; but I would argue that they do so only when they become perceptible, either because they take place very rapidly (e.g. earthquakes or population explosions), or because they cross a 'threshold' beyond which they have to be perceived because they directly threaten survival (e.g. the slow deterioration of an environment leading to a gradual decrease in an important food resource up to the point where the resource is no longer available in sufficient quantity to support the group or individual in its traditional way of life). Conflict within or between groups is, in contrast, always perceptible, because it is of human origin and thus takes place within a timeframe normal to human existence. Therefore, conflict will be more often perceived than environmental or demographic change, and will thus be disproportionately better represented in the individual world view. It follows that conflict could easily be more important in decision-making, and consequently in cultural change than other, less perceptible events.

Please note that the model described here differs from that of dialectical materialism, which, while recognising the important role of conflict in cultural change, sees it primarily as the expression of economic and instinctive imperatives.

### Some implications for archaeologists

In this paper I have argued that both Darwinian and Spencerian cultural evolution are highly questionable explanations of cultural change. Many of the points made during this argument have been forcefully stated elsewhere, yet these repeated cautions seem to have had very little impact on archaeological interpretation. The concepts of adaptation, of material, environmental or Malthusian determinism are still very widely used as explanations of cultural change. One may ask oneself why these models are used so uncritically by so many archaeologists. I believe that the answer lies in the limited nature of the archaeological record. Archaeologists, like other (social) scientists, have the very natural desire to explain their data in as complete a manner as possible. The archaeological record, however, is limited to material remains (at least in prehistory). These allow often the reconstruction of the economy and of the natural environment surrounding a prehistoric people; they do not usually permit any detailed analysis of social behaviour in general, or of internal and external conflict in particular. A seemingly complete explanation of cultural change in prehistoric societies can thus only be achieved by using materialist theories, i.e. models where social behaviour is either firmly linked to the material 'base' (the economy), or where it is determined by the environment (Watson, LeBlanc & Redman, 1971, 106). Yet, an examination of human behaviour as contrasted to animal behaviour, as I have tried to outline in the preceding section, must lead to an emphasis on the importance of perception and self-

consciousness, and thus to the rejection of materialist theories as complete explanations.

This may leave archaeologists in something of a quandary. A comprehensive explanation of cultural change would presumably require data on social behaviour which is, and will be for the foreseeable future, not available to the prehistorian. Consequently, while continuing to search for observable factors influencing cultural change, such as changes in the natural environment and in the economy, we should admit that we cannot provide, and perhaps never will be able to provide, more than a partial explanation of change in prehistoric cultures.

## References

- Borgerhoff-Mulder, M. 1987. Adaptation and evolutionary approaches to Anthropology. *Man*, 22(1): 25-41.
- Bray, W. 1973. The biological basis of culture. In: Renfrew, C. (ed). *The explanation of culture change: models in prehistory*. London: Duckworth, 73-92.
- Bronowski, J. 1973. *The ascent of man*. BBC publications.
- Burnham, P. 1973. The explanatory value of the concept of adaptation in studies of culture change. In: Renfrew, C. (ed). *The explanation of culture change: models in prehistory*. London: Duckworth, 93-102.
- Childe, V.G. 1951. *Social evolution*. London: Watts & Co.
- Darwin, C. 1900, orig. 1859. *The origin of species*. London: John Murray.
- Darwin, C. 1871. *The descent of man and selection in relation to sex*. New York: D.Appleton,
- Dunnell, R.C. 1980 Evolutionary theory and archaeology. *Advances in archaeological method and theory*, 3: 35-99.
- Durham, W. 1976. The adaptive significance of cultural behaviour. *Human ecology*, 4(2): 89-121.
- Engels F. 1954, orig. 1884. *Origin of the family, private property, and the state*. E. Untermann, transl. Moscow: Foreign languages publishing house.
- Flannery, K.V. 1969. Origins and ecological effects of early domestication in Iran and the Near East. In: Ucko, P. & Dimbleby, G. (eds). *The domestication and exploitation of plants and animals*. London: Duckworth, 73-100.
- Gould, S.J. 1980. *The Panda's thumb: more reflections in natural history*. Harmondsworth: Penguin books.
- Harris, M. 1969. *The rise of anthropological theory*. London: Routledge & Kegan Paul.
- Hempel, C. 1966. *Philosophy of natural science*. Englewood Cliffs: Prentice Hall.
- Ingold, T. 1986. *Evolution and social life*. Cambridge: Cambridge University Press.
- Keene, A.S. 1983. Biology, behaviour and borrowing: a critical examination of optimal foraging theory in archaeology. In: Moore, J. & Keene, A. (eds). *Archaeological hammers and theories*. New York: Academic Press. 137-155.
- Kirch, P.V. 1980. The archaeological study of adaptation: theoretical and methodological issues. *Advances in archaeological method and theory*. 3: 101-156.

- Montagu, A. 1976. *The nature of human aggression*. Oxford: Oxford University Press.
- Morgan, L.H. 1877. *Ancient society*. New York, World Publishing.
- Rappaport, R.A. 1977. Maladaptation in social systems. In: Friedman, J. & Rowlands, M. (eds). *The evolution of social systems*. London: Duckworth, 49-71.
- Rindos, D. 1985. Darwinian selection, symbolic variation and the evolution of culture. *Current anthropology*, 26(1): 65-88
- Rindos, D. 1987. Darwinian evolution and cultural change: the case of agriculture. In: Manzanilla, L. (ed). *Studies in the neolithic and urban revolution: the V.Gordon Childe Colloquium, Mexico 1986*. Oxford: B.A.R. International Series 349, 69-79.
- Smith, E.A. 1983. Anthropological applications of optimal foraging theory. *Current Anthropology*, 24: 625- 651.
- Steward, J. 1955. *Theory of culture change*. Urbana: Univ. of Illinois Press.
- Tylor, E.B. 1871. *Primitive culture: Researches into the Development of Mythology, Philosophy, Religion, Language, Art and Custom*. London: J. Murray.
- Watson, P.J., LeBlanc, S. & Redman, C. 1971. *Explanation in archaeology: an explicitly scientific approach*. New York: Columbia Univ. Press.
- White, L., 1949. *The science of culture*. New York: Grove Press.
- Whyte, A. 1977. Systems as perceived: a discussion of 'Maladaptation in social systems'. In: Friedman, J. & Rowlands, M. (eds). *The evolution of social systems*. London: Duckworth, 73-78.