Chapter 28. SUMMARY AND REVIEW

> Many of the views which have been advanced are highly speculative, and some will no doubt prove erroneous; but in every case I have given the reasons which led me to one view rather than to another. It seemed worthwhile to try how far the principle of evolution would throw light on some of the more complex problems in the natural history of man.
>
> Charles Darwin, 1874
>
> *The Descent Of Man* (Summary and Conclusion)

I. Broadest Issues of the Book

A. The Claim for an Ecological/Evolutionary Approach

As you perhaps recall from the first chapter, we said that the overarching question of the book was how adequate the ecological/evolutionary approach was for understanding human behavior. *Does theory and method borrowed from biology—but extensively remodeled to fit the peculiarities of the human case—provide a proper foundation for a science of this particular animal?* The special claim of human ecology is not to replace the conventional social sciences (or sciences of human biology) but rather to provide a framework for synthesizing the many disciplines that contribute to understanding *Homo sapiens*.

This is a controversial thesis in some quarters. *This book can be read as an extended essay arguing in favor of it*. Each of the book's substantive chapters is intended to review a bit of theoretical reasoning or a body of data that can be fitted into a synthetic ecological/evolutionary science of human behavior. Some of this material was directly inspired by ecological ideas, but much of it was drawn from classical social science concepts, models, and hypotheses that human ecology claims to be able to integrate. Thus, you will have learned a lot of social science and related material in this book, whether or not you think the main thesis justified!

No single social science discipline has the breadth of ambition of human ecology. Ordinarily, a thesis like this should be argued comparatively. "Human ecology is a better approach than its alternatives, _____, and _____." However, there really are no alternatives to the ecological/evolutionary approach. Typical approaches to the the explanation of human behavior are limited to particular levels of organization (psychology, sociology), to the question of origins but not contemporary behavior (paleoanthropology), or to contemporary behavior but not its origins (economics). To be sure, there are many cases in which there are objections to particular planks in the ecological platform. There are also those that deny that scientific methods are really applicable in the case of

humans. But we do not think there is any other scholarly tradition in the social sciences with quite the same synthetic intentions as human ecology, which aims for an account of human origins and behavior drawn from all the relevant disciplines including biology, the geophysical sciences, the social and behavioral sciences, and history.

B. Alternatives to Anthropocentrism, Ethnocentrism, and Mythology

Another important subtheme in the book is the idea that social scientific ideas are a substitute for anthropocentrism, ethnocentrism, and mythologizing about human behavior. For example, we think it important to understand that arms races may not be due in any important part to the evil intentions of our enemies (or the military, or the CIA, etc.) but rather to the game logic inherent in particular situations. Avoiding arms races may mainly be a matter of evading this logic. In fact, if this is so, searching for bad guys is a waste of time. Focusing our attention on mythical enemies could well be a dangerous diversion! Myths provide a sense of comfort in an uncertain world, but it is most important these days that we deal with the *real* problems. Only a scientific approach holds much promise for separating myths and reality. Badly intentioned people are a problem, but for our part we fear even 'innocent' myths more.

II. Relationships Between Major Blocks of the Book

There were four major blocks of chapters in the book. It will help you to put the whole field in perspective if you think about the basic nature of each block and their relationships to one another.

A. Human Natural History

In this series of chapters, we surveyed the diversity of human societies using the technology-culture core idea of Steward as an organizing principle. It was essentially a review of what has been discovered about human behavior using the ecological/evolutionary approach. This knowledge lies short of the intellectual frontier; but we have to traverse it in order to get to the exciting, confusing questions that actually do lie on the frontier. The essential discovery discussed in this section is that there is a strong correlation between the technology employed by a society and social and political institutions, most especially when environmental variables are taken into account to explain variation within subsistence types. There is even a relationship to psychological variables (recall the cognitive style and child-rearing practice relationship.) Steward and his followers succeeded in making adaptation to environment via technology a powerful idea, but that they did not satisfactorily solve the four problems of Chapter 2. For example, their progressivist account of evolution, and hence of the concept of adaptation, is very weak.

B. Theory of Human Evolution

To remedy the ecology/evolution weakness of Stewards approach, the second part of the book introduced models of evolutionary processes derived using the methods used by Darwinians to understand organic evolution. The key to this approach is to focus on populations of variable individuals, and to study what happens to heritable variation as populations move through time. We used relatively simple models of human life cycles to break the evolutionary process down into a series of structural variations and evolutionary forces that allow us to account for what happens to individuals as they acquire their heritable variants and try to use them to make a living. Things already get pretty messy, as genes and culture interact with one another, and each is affected by several evolutionary processes at the same time.

However, some of these complexities of culture and gene-culture coevolution are attractive because they give us reasonable preliminary answers to some of the most puzzling features of human behavior. For example, the sociobiological forces of guided variation and direct bias account for why culture frequently seems to produce adaptations very much like those of ordinary organisms, while frequency dependent bias and indirect bias might account for why humans are so cooperative and so prone to generate seemingly maladaptive or nonadaptive symbolic variation.

These ideas are all controversial and uncertain of ultimate success; here we are operating on the frontier. We believe that the understanding of human evolution that is ultimately incorporated into more secure knowledge will look a lot like what you have studied here, but then we're partisan reporters. An obvious defect of these models is that they treat the environment in rather stylized and abstract terms as selective forces, information acquired by experience, and the like. They lack much of the gritty feel of real populations interacting with real environments.

C. Systemic Interactions

It is to a more realistic account of such complex environment/population interactions that we turned in third block of chapters. We looked at population regulation, environmental impacts, collective decision-making, disease, trade, warfare, and the diffusion of innovations. Our focus was on the society or population as the unit of analysis, but we argued that many of the same interactions, suitably modified as to detail, also obtain between smaller units, down to individuals, within societies.

We hope you see the close relationship between the abstract evolutionary processes of the previous section with the processes we examined in this one. It is the ecological processes in this section that actually drive the more abstractly presented evolutionary process-

es of the previous one.

For example, it is the ecologically determined advantages of trustful cooperation within groups that, combined with the peculiarities of cultural transmission that perhaps account for why organized warfare is the typical mode of human conflict, and why international trade was for so long organized by ethnic trade diasporas. For another example, the studies of diffusion of innovations we examined suggest how the costs of information and decision-making that were such a large part of the theory of cultural evolution actually work out in practice. We also examined how population growth processes generate the selective and decision-making pressures that are central to models of evolutionary processes. Of book, the evolution of technology and norms has a potent effect on demographic processes; ecology and evolution are opposite sides of the same coin. Even more basic perhaps, the myopic, step by step nature of evolutionary processes helps us account for the environmental deterioration dynamics that often occur.

Recall the skeletal explanatory formulas that were introduced in the first chapter:

Ecological equation:

Phenotype = *f* (genes, culture, environment)

Evolutionary equation:

Genotypes = *f* (past environments, evolutionary forces)

By the end of this block of chapters, there was some flesh on all these bare bones.

D. Evolutionary Transformations of Human Ecological Patterns

To test how far we could get with tools at hand, we examined the main revolutions in human subsistence.

The first problem was to stretch the microevolutionary time scale considered in the chapters in block B to the macroevolutionary one. Recall that this is a problem of accounting for limitations to the rate of evolution due either to internal processes within the evolving populations or external to it in the environment. For example, long stable environments may find most populations on adaptive peaks, so that further evolutionary change depends on environments changing.

However, a sudden environmental change may set in motion a complex, slow, and halting series of evolutionary changes as populations climb a rough fitness hill with many local optima where they get stuck for more or less long periods of time, depending on a great many ecological details. The time scale for cultural evolution can be at least 10,000 years, if the idea is correct that the change in variation in climate 10,000 years ago set off

the train of human evolutionary responses of which we are still part. We reviewed several hypotheses to explain major human ecological revolutions using various *internalist* arguments.

On longer time scales, the externalist idea that macroevolutionary patterns are mainly due to the geophysical evolution of the Earth, the simplest macroevolutionary extrapolation from our microevolutionary theory, might well be correct, as the relative stability of upper paleolithic peoples from 40,000 to 10,000bp suggests.

III. Review of the Four Problems of Human Ecology

An alternative approach to reviewing where we have come in this book (highly redundant with the one above) is to ask: how far have we gone toward solving the main problems humans pose for ecological analysis? We introduced these four questions in the second chapter of the book, where we suspect they seemed a touch abstract to most of you. However, because they summarize the main underlying themes that tie all parts of the book together, they now are worth raising again for you to think about as you review the book.

A. The Relationship Between Genes and Culture

How are we to understand culture as a means of adaptation to environments?

If culture is a system of inheritance, we can use Darwinian methods, population thinking—remember, the implication here is that we ought to make a close study of heritable variation; if we can understand the small-scale dynamics of how cultural variation is acquired and transmitted, we can solve this and the other four problems, at least in principle. Recall that "in principle" means in part that we keep environments simple.

Sociobiological hypothesis:If the decision-making forces are very strong, and selection operates on the determinants of these forces, culture is adaptive in a straight-forward way. The argument from natural origins guarantees that this must be true in some sense, or to some extent.

Costly information hypothesis: If culture is a means of evading information costs, decision-making forces will be weak, selection and other forces acting on cultural variation can favor traits that are maladaptive from the genes' point of view

Evidence: We have reviewed much evidence that can be accounted for by the sociobiological hypothesis (e.g., the importance of kinship in social organization). We have also reviewed evidence such as the demographic transition that is difficult to reconcile with sociobiological thinking. Some of the evidence we looked at (e.g., patterns of the diffusion of innovations) make it seem as if people treat decisions as costly to make.

B. Relationship Between Ecological and Evolutionary Processes

How do humans relate to their environments and what are the long-run consequences of this interaction?

> *Technology and the culture core concept*: Steward's idea shows how technology-environment interactions can powerfully influence the culture core, and the core potentially includes much of the cultural repertoire. But Steward's evolutionary account is separate from his ecological ideas, and this is unsatisfactory.

> *The forces of cultural evolution*:We saw how selective and decision-making effects acting on culture interact with the environment and with the processes of organic evolution; we can see how ecological processes can generate long-run patterns of change in the cultural as well as the biological case.

> *Coevolutionary complexity*: Environment-population interactions can generate very complex and often counter-intuitive processes. This is particularly so when the environment itself is part of the evolving system, as in the case of environmental impacts, interactions with other species (e.g. disease organisms, or other human tribes, classes, or nations). Evolutionary "games" often exhibit behavior that is unexpected within the framework of a fixed environment. For example, positive feedback loops can get set up that cause a long train of evolutionary consequences, after the fashion of an arms race. We saw hypotheses advanced that the most disease-ridden populations have an advantage in intersocietal conflict; that morally dubious market mechanisms can create enough technical progress to make whole nations prosperous, that an irrational willingness to fight may be rational, and so on.

These complexities make it very difficult to understand the tempo and mode of human evolution (or organic evolution for that matter) in simple terms. For example, in our examination of the main evolutionary events in human history, we often had trouble accounting for them with a simple externalist hypothesis; progressive internalists ones often seemed necessary. In no case could we even hypothesize that there was a simple univariate explanation for the tempo and mode of human evolution.

C. Group Size and Levels of Cooperation

Why are humans, compared to most other animals, able to organize themselves on such a large scale?

> *The public goods problem:* Cooperation is hard to achieve in large groups. The reciprocal altruism solution of sociobiologists is at least debatable in the human case.

> *Group selection on cultural variation:* Group selection may be more frequent in the cultural than in the genetic case via conformist transmission (frequency dependent bias) and runaway effects, and the low costs of these transmission rules may generally prevent individual-level selective processes from undoing them.

Large-scale cooperation very important: We met examples of large-scale cooperation, including warfare, and organization based on ethnic and class sentiments (e.g., the importance of interest groups within societies that organize themselves to collectively favor or oppose policies).

Note well that the existence of cooperation at one level has a tendency to cause problems of intensified conflict at others. War is the most extreme example, but the problems of solving large-scale public goods problems in societies with interest groups can also be a problem, as we saw in the case of voting paradoxes. At the same time, forcing individuals to interact only through markets has its problems as well.

D. Symbolic Behavior

Why do modern humans engage in such elaborate rituals, pursue such seemingly irrational prestige norms, and believe so strongly in objectively ridiculous ideologies?

The hypothesis of the symbolic anthropologists: Recall that the strongest objections to any sort of ecological/evolutionary theory come from the idea that the use of symbols frees us from ordinary adaptive constraints on our behavior. It has been claimed that this means that the whole approach we have taken in this book is misguided.

Indirect bias and the runaway process: In order to answer this criticism, we proposed a systematic explanation of how cultural evolutionary processes could produce maladaptations. At the same time indirect bias and symbols have many individual and group fitness enhancing functions. The argument here is that the methodological objection of the symbolic anthropologists can be met, but they might be more or less correct on the substantive issue; perhaps some human behavior is just plain maladaptive.

Evidence: We saw the importance of indirect bias in the opinion leadership phenomenon of innovation diffusion. Extensive symbolic capacities appear to be a late development in human evolution, and one might imagine that the spurt of human evolution during the last 100,000 years has something to do with this. We saw some potentially important uses of symbols, as in the ritualization of conflict. Weber's Protestant Ethic hypothesis suggests that the runaway process might sometimes have very important consequences.

IV. Conclusion

We said at the beginning of the book that human ecology is an area of science where the frontier problems of the discipline can be presented in a way that makes minimal demands on previous knowledge. In this book we've tried to expose you to this frontier. Now you can see what that means more clearly. We have more interesting hypotheses than firm answers, and no little amount of plain confusion. By no means are all of the problems of understanding human behavior well posed, let alone solved. We've thrown some more light on these problems since Darwin's day, but they remain complex ones. For a scientist, this is home, a veritable Bre'r Rabbit's briar patch of interesting, unsolved problems. (In the ep-

igraph quote, Darwin meant to signal this fact to his readers, at least as much as he wanted to be apologetic.)

We hope you have enjoyed this aspect of the book; it is the most fun for scientists themselves. The frontier is where a practicing scientist finds real problems to solve. However, we sometimes worry that science is a poor spectator sport. Studying the known facts is rewarding and useful, and speculating loosely about the unknown is fun. Actually working on the scientific frontier to reduce chaos, error, and confusion to orderly knowledge is apt to be confusing, boring, and just plain *hard work*—like life on a real frontier. Some of the ideas may even be downright scary. Scientists suffer all this for the occasional thrill that comes from discovering an important bit of new knowledge for oneself.

Even if you did not enjoy it, we hope you have gotten some insight into the somewhat perverse motivations of scientists. We find unsolved problems exciting, but only if we think we can solve them. And we find solid answers, once they really are solid, boring. This is more or less the opposite of what sensible people prefer. Solid answers are useful, and unsolvable ones are fun to argue about. Scientists get their kicks working very hard to turn fun things to think about into boring, usually complicated, occasionally useful, facts!

On another level, however, the lack of good, well-verified answers to the big questions in human ecology, and in the social sciences more generally, is a bit scary. Our high level of ignorance about the causes of human behavior is not reassuring. The idea that arms races and the dangerous game of war are a virtually natural phenomenon—and thus extremely difficult to control—is a positively chilling thought. Arrow's idea that there is no guarantee that human collectivities can act according to simple norms of rationality, or Boyd and Richerson's hypothesis that absurd cultural norms can arise through runaway indirect bias, are no help for sleepless nights. The Easterlin-Frank idea that modern growth economies are bad or not good strikes at one of the few ideas for which there is a degree of consensus in the modern world. We share the planet with a large, dangerous, unpredictable animal, each other.

We, for one at least, find it uncomfortable to live on the same planet with a bunch of big, dangerous animals that we do not understand very well. Writing some chapters in this book feels a bit like writing the script for a horror movie, except that it really happens! Perhaps the most important practical message of this book is that we do not yet know enough about humans to reliably control our more dangerous and destructive behaviors. Until we do, the human adventure is often liable to be a little more exciting than one would like.