

# A Darwinian Framework for the Economic Analysis of Institutional Change in History

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## 1. The Need for a Response to Marshall's Challenge

Since Alfred Marshall expressed his conviction that economists should search in the field of biology instead of the field of mechanics for methodological affinities, nothing has changed in the physicalist foundation of economics. Just the opposite—many economists believe that the successful application of economic models in biological disciplines like behavioral ecology (e.g., Stephens & Krebs, 1986) ought to be regarded as a further instance of successful “economic imperialism” outside the field of economics proper (e.g., Tullock, 1987). Obviously, they do not pay attention to the fact that economic models in biology are firmly embedded in a theoretical framework that transcends economics, i.e., Darwinian evolutionary theory. That economics has been applied successfully in the life sciences is precisely what can be explained only by means of Darwinian arguments: identification of causes is possible only via theoretical reconstruction of evolutionary paths of change, i.e., theoretical explanations as opposed to mere descriptions of “efficiency.” Hence, the evolutionary perspective on economics differs considerably from the methodological attitudes of economic “normal science” (Smith, 1983b).

In general, there are three possible responses to Marshall's challenge. Up to now, the cross-fertilization between biology and economics by means of analogy has been the way preferred by heterodox economists (e.g., Nelson & Winter, 1982; Winter, 1987). Methodologically, this approach includes the straightforward rejection of any claim of a common theoretical foundation of biology and economics. The most conclusive argument, of course, goes back to the observation that human behavior is no longer predominantly governed by genetically transmitted rules (Witt, 1989). Hence the Darwinian selective process presumably does not work in the case of human beings, albeit perhaps on the level of biological determinants of preferences, cognitive capacities, and so on.<sup>1</sup>

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The second possible approach pushes the frontier forward by turning from analogy to homology. This is the perspective of synergetics and the theory of dissipative structures (Haken, 1983; Cambel et al., 1989). The evolutionary argument is generalized by elaborating on its fundamental mathematical structure, so that biology, economics, certain fields in physics, etc. are reduced to a common theoretical foundation.<sup>2</sup> Competitive processes are modelled by means of the concepts of random variation and selective retention, which are supposed to explain phenomena of order within self-organizing non-equilibrium systems. In regard to economics, perhaps such an approach leads to a complete reformulation of its theoretical structures. Quite similar to the biological usage of economic models, standard hypotheses of microeconomics would no longer be regarded as explanations of economic phenomena but as theoretical descriptions of the final state of a dynamic process which, in turn, has to be explained by the more fundamental hypotheses of synergetics. However, this does not imply that, between different models resulting from the application of the mathematical structures of synergetics, theoretical links are established that go back on the common interpretation of certain empirical variables or parameters. That is to say, this still provides no way to interpret economics in terms of biology. Of course, the claim that there is such a possibility does not preclude the adoption of a synergetic approach.

Just that claim is put forward by the third possible response to Marshall. Subsequently, I will briefly elaborate on the relevant considerations.<sup>3</sup> This approach will be called "Evolutionary Anthropology." From the perspective of economics, a first acquaintance with a similar line of thinking was made when classical sociobiology tried to reduce individual behavior to the norms of inclusive-fitness-maximizing (Alexander, 1979; Chagnon & Irons, 1979). However, no perspectives for cross-fertilization resulted because classical sociobiology does not acknowledge the pivotal role of institutions (mostly labelled "culture" by non-economists) in shaping human behavior (Boyd & Richerson, 1985, pp. 157ff.). Even economists who do not adhere dogmatically to the neoclassical foundations of their discipline were unable to discover any relevance of sociobiology for economic analysis unless very simple stages of human institutional development were scrutinized (Tietzel, 1983; Witt, 1985). Regarding the crucial question of preferences, there seemed to be no empirically sensible way to establish a relationship between preferences for goods and the norm of inclusive-fitness-maximization (Tietzel, 1989).<sup>4</sup>

However, after the controversies about first-generation sociobiology, the challenge for any attempt to link biology and economics can be posed concisely: If one can demonstrate that institutions governing human behavior can be grasped at least partially by biological considerations, perspectives for cross-fertilization will be discernible.

When Marshall's challenge is rewritten in that way, the stage is set. Obviously, human institutions do affect biological aspects of human life. As recent events in Eastern Europe have shown in a sometimes shocking way, economic systems do not only determine living standards as reflected in the availability of consumer goods of different quality and quantity, but affect such fundamental biological phenomena as ecological equilibria, the stability of the family, etc., which in turn determine birth and death rates or physical and mental health. Such an observation is sufficient to support biological research strategies in the broad sense (Corning, 1983; Freye, 1986, pp. 164ff.; Dunbar, 1987). Nonetheless, we have no guarantee that the adoption of biological research strategies will lead to a strong theoretical linkage between economics and biology and their respective theoretical foundations. For instance, although environmental economics has offered for at least the past two decades an oppor-

tunity to intensify theoretical cross-fertilization by embedding economics into general ecology, this opportunity has been utilized only by specialists, with no change in the theoretical core of economics (Sommer, 1989). Obviously, Marshall's challenge needs to be reformulated in a way that triggers theoretical curiosity among representatives of economic "normal science." The most promising point of departure seems to be the New Institutional Economics.

## 2. The Theoretical Incompleteness of the Economic Analysis of Institutions

Evolutionary theory as the foundation of evolutionary anthropology meets economics when institutions are in focus. Of course, if topics like market structures or enterprise organization are scrutinized, the distance between economics and biology is very large indeed. However, if long-term changes of basic institutional structures of economies and societies are analyzed, the interaction between institutions and biological variables becomes obvious, as, e.g., reflected in changes of the population growth rate or in fundamental effects on the environment. From the outset we need to choose the appropriate time scale and the appropriate degree of generality of the phenomena in question. Hence, economic theories of long-term institutional change are the relevant counterparts of evolutionary anthropology. This has already become apparent in available comprehensive approaches like Marvin Harris' (1979) "Cultural Materialism," where the relevant economic theory is Marxist historical materialism. Although biological variables like population growth are crucial to Cultural Materialism, meaningful reduction to the then flourishing sociobiological hypotheses was declared impossible.

D. C. North's (1981) subsequent theory of institutional change ought to be regarded as the most promising candidate for cross-fertilization, because unlike Cultural Materialism, North on the one hand adheres as close as possible to the theoretical core of standard neoclassical economics (starting from the assumptions of methodological individualism, utility, property rights, and transactions costs), and on the other hand acknowledges the existence of missing links in a purely economic logic when explaining institutional change. In the original statement of his argument, North hints at the theoretical incompleteness of property-rights theory, and calls for complementary theories of the state and of ideology. More recently, he concludes that institutional change as a rule is triggered or impeded by the political system and by the peculiar way it processes social and especially distributional conflicts arising from the changes in the structure of property rights (Libecap, 1989). Political determinants of institutional evolution attain causal priority in relation to economic determinants (North, 1989). Ultimately, this amounts to the rediscovery of Max Weber (1922/1985) by economics (see Herrmann-Pillath, 1991).<sup>5</sup>

North's insights affect the theoretical core of economics even more fundamentally when the issue of "efficiency" is tackled (Furubotn, 1989; Binger & Hoffman, 1989). The problem has two aspects: first, how can the efficiency of economic institutions in the narrow sense be evaluated and compared; second, how can the same task be accomplished when the interaction between politics and the economy is under study, i.e., institutional change *lato sensu*?

Regarding the first question, North is compelled to adopt a basically circular argument (Richter, 1990): "Efficiency" is supposed to be reflected in the growth of national income as measured within the framework of the institutions of which the efficiency has to be assessed.

Such a concept of efficiency either presupposes an inherent evolutionary drive of institutional change towards the growing internalization of social costs, and thereby, of course, begs the issue just at stake (Tietzel, 1985, p. 157), or becomes a historically contingent, path-dependent measure that can only be interpreted empirically within the context of systems competition, as, e.g., in the recent case of capitalism and socialism. In the latter case, no objective standard is available which can be applied by an outside scientific observer (Streit & Wegner, 1988), unless the still unproven hypothesis is accepted that by necessity competitively successful institutional regimes actually represent more efficient solutions in the economic sense. Although in the case of socialism this seems to be obvious, other cases in history lend themselves to no easy interpretation.

In imperial China (Herrmann-Pillath, 1989; 1990a, 1990b), for example, the competitive superiority of Western capitalism over the traditional order was established in military terms, based on the technological foundation established during the Industrial Revolution.<sup>6</sup> Economically, China's incapacity to industrialize presumably can be explained by purely ecological considerations (Elvin, 1973), quite to the contrary of Smith's and Weber's classical institutionalist reasoning. In fact, Western capitalism needed several decades to convert its military advantage into an economic advantage (Osterhammel, 1989). But even then the effects of the earth-shaking destabilization of the traditional political order cannot be disentangled conclusively from the effects of the comparative efficiency of economic institutions in the narrow sense. Can we thus reasonably assume that success in military competition necessarily reflects a higher degree of economic efficiency?

The example shows that efficiency in the narrow sense cannot be scrutinized independently from efficiency in the broad sense, or "global efficiency." In regard to global efficiency, North's approach fails completely because there is no way to compare the positive effects of state power on economic and societal development that result from the production of public goods (as, e.g., the military) with its negative effects caused by coalitions between interests groups and political power impeding efficient changes in the structure of property rights.<sup>7</sup> Only the latter are focused on by North. For instance, enclosure in Great Britain was fostered by strong supporting interest groups in parliament (Braun, 1975), whereas in France the constellations of interest groups worked just in the opposite direction (Hoffman, 1989)—driving the country into a Malthusian crisis until the shift to a more efficient institutional regime occurred as an unintended side-effect of the French revolution. A methodologically sound comparison of both developmental paths would be possible only if the utility resulting from the distributive effects of the different institutions could be compared with regard to the different interest groups and, of course, outsiders in question (Brooks et al., 1990). Unless an objective standard of measurement is provided, institutional economics remains theoretically incomplete.

Now, if we alter our theoretical perspective, just that incompleteness offers a unique opportunity for establishing a linkage between economics and evolutionary anthropology, because outside of economics a long tradition exists of asking for global efficiency in terms of ecology—culminating, for instance, in the above mentioned work by Harris. A classical, albeit historically naive, argument was Wittvogel's theory of oriental, i.e., hydraulic despotism. It has a grain of truth that triggers highly complex arguments about the adaptive effects of state power even in modern anthropological inquiries about the origin and the evolution of the state (e.g., Kowalewski & Finsten, 1983; Brumfiel, 1984; Claessen et al., 1985; Sanders & Nichols, 1988). From the perspective of institutional economics, the argument can be

reformulated straightforwardly: Ask not for the efficiency of economic institutions but for the global efficiency of the interaction between power and the economy in specific societies, as reflected, e.g., in ecological determinants of population growth or of competitive success in military conflict. Such an approach to measurement is not equivalent to an explanatory theory based on the analysis of human actions because only in rare cases is the interaction between power and economy driven by knowledge of the agents about efficient institutional alternatives. Accordingly, there is no inevitable drive in history directed to higher global efficiency.

The concept of global efficiency obviously is closely related to the concept of “adaptation” in ecological theories of the state that easily lends itself to a biological interpretation (Rudolph & Tschohl, 1977). Indeed, in contrast to classical sociobiology, the adaptive consequences of institutions—as opposed to individual behavior guided by institutions—serve as an essential conceptual link between biology and economics that does not lead to the claim that individual behavior as such can be reduced to elementary Darwinian hypotheses. However, such an intuitive conjecture is still a far cry from a thorough and concise theoretical foundation that might be able to explain the observed coincidence, perhaps even co-evolution, of human biology and society (Durham, 1979; Lumsden & Wilson, 1981; Dyson-Hudson, 1983; Findlay & Lumsden, 1989). The crucial issue consists in resolving the puzzle of how the mere description of adaptive consequences of institutions might switch to an explanation founded in biology.

Below I outline eight general conjectures that might serve as a theoretical framework for integrating central concepts of biology and the social sciences like “fitness,” “adaptation,” “power,” and “utility” without suffering from the excessive reductionism of first-generation sociobiology.

### 3. Outline of a Darwinian Framework for the Economic Analysis of Institutional Change

In the interest of brevity, I present eight rather complex statements—“Propositional Sets”—that combine hypotheses, definitions, etc. Each is followed by short comments of clarification.

**Propositional Set 1.** *The objects of evolutionary anthropology are individuals and rules as stores of information. Rules are stored and transmitted either by means of genes or by means of phenotypic properties including extra-corporeal artifacts. Rules governing social interaction between individuals are called “institutions.” Individuals are exposed to selective pressures resulting from the physical environment and from competition with other individuals for resources. Institutions are exposed to selective pressures resulting from the actions of individuals. Sets of individuals and rules related to each other at a certain point of time reflect previous differential reproductive success of rules on the different levels of selection.*

Evolutionary anthropology adopts “psychoneural monism” (Bunge, 1980), which means that the underlying ontology does not attribute existence to supra-individual phenomena like “culture,” “values,” and “norms.” Nevertheless, the concept of “rule” is apt to deal with such kinds of phenomena. But notice that “rules” are theoretical terms used by the scientific observer for explanation of the behavior of individuals that can be described without recurring to those terms (Stegmüller, 1986). This perspective is consistent with the

approach of biology when the concept of "gene" is introduced (Mayr, 1982, pp. 777ff.; Dawkins, 1989, pp. 20ff.). Hence, in the case of non-genetical rules the observer needs to search for physical properties of individual phenotypes which can be supposed to serve as informational stores—as, e.g., neuronal phenomena perhaps caused by the interaction between individuals or between individuals and artifacts (Delius, 1989).

The distinction between two types of rules was first proposed by Dawkins, who introduced the gene/meme-dichotomy. Given different selective contexts, Dawkins rejects the possibility that the selective process occurring during competition between memes could be governed by the success criteria determining differential reproduction of genes. This amounts to an outright rejection of our basic conjecture. To put it bluntly, in that case any kind of positive adaptive consequences of human institutions might merely be the result of chance.<sup>8</sup> However, as Boyd and Richerson (1985) have shown in considerable analytical depth, any kind of a "dual inheritance model" which presupposes two different types of rules implies a fairly large range of possible interactions between genes and memes. We might suspect that even though the evolution of memes might run contrary to the evolution of genes within a certain period of time, in the long run evolutionary stable constellations presuppose a non-contradictory relation between the information stored in genes and memes (Rindos, 1985; 1986). Note that this hypothesis does not lead to the conclusion that the information needs to be identical.<sup>9</sup>

A crucial aspect of Propositional Set 1 is the assumption that institutions in particular are not exposed immediately to selective pressures resulting from the natural or social environment, which concurs with Dawkins' critique of naive adaptationism (Bateman et al., 1990). An opposite opinion is implied, for example, by the above mentioned ecological theories of the state, and resulted in one of their major weak points because, of course, institutions and the physical environment exist on completely different conceptual and even ontological levels (Bargatzky, 1984). Evolutionary anthropology instead starts from the idea of "selective heterarchies" (Lumsden & Wilson, 1981, p. 108).<sup>10</sup> Within selective heterarchies, although an encompassing interdependence of all levels of selective processes obtains, immediate selective pressures of a certain type presumably never reach beyond the next selective level. For instance, selective pressure on genes cannot reach through institutions. Hence, one of the most important research topics in evolutionary anthropology is the attempt to identify mechanisms that mediate between selective processes on different hierarchical levels.

**Propositional Set 2.** *The proximate goal of individual behavior and actions is to maximize power and to optimize its structure. "Power" includes wealth, the capacity to achieve individual aims even against the will of other individuals, and the capacity to influence institutional change. Individuals maximize utility, given certain restrictions. However, utility-maximizing behavior is stable in the long run only if no conflict occurs between utility maximization and the proximate goal to achieve power.*

Set Two establishes the crucial methodological difference between evolutionary anthropology and economics. At the same time, the fundamentals of economics are embedded in the general evolutionary perspective. In the history of ideas, the concept of "power" goes back to Hobbes, who had a more general understanding of that term than, e.g., Weber: "Power" includes all the instruments "to obtain some future apparent good," in which "goods" are the means needed for the preservation of life (Kliemt, 1985, pp. 21ff.). A similar approach to the concept of power has been chosen in recent extensions of Darwinism to the

human sciences (Betzig, 1986), although the consequences still have to be explored (Dunbar, 1988).

In interesting contrast to the economic concept of “utility” as a subjective phenomenon, “power” lends itself to empirical observation. First, we know from ethnological research that human cognitive capacities presumably evolved out of the functional needs resulting from the selective pressures of complex social interaction within groups (Grammer, 1989, pp. 32ff.). We seem to have a genetically fixed drive for development of dominance hierarchies through social interaction, which contributes to the solution of adaptive challenges. Second, power rests upon social recognition and therefore by definition needs to be observable. This is especially valid for the concept of “wealth,” which establishes an additional link to economics—where “wealth” has to be regarded as a social category (for instance, discounted future income as evaluated by market prices), and in contrast “goods” are valued according to subjective utility (Heilbroner, 1987). Third, even if individuals are supposed to maximize utility predominantly, “power” turns out to be an observable phenomenon when a conflict between utility maximization and power goals occurs (e.g., in the case of drug addiction).

Set Two has far-reaching implications. The methodologically most important one lies in the essentially relational quality of power, again in contrast to subjective utility. Since by definition power can only be perceived in comparison to the power status of other individuals, something like total socioeconomic equilibrium simultaneously satisfying the goals of every individual (assumed by concepts like “Pareto-optimality”) can never exist, given budgetary restrictions.<sup>11</sup> If one individual enhances his/her power status, the power status of every other individual necessarily diminishes; there is no way to improve the position of one individual without worsening the position of others. Yet the Pareto-optimality proposition is the core concept of economic welfare considerations. On the other hand, economic belief in the “insatiability of wants” can be reformulated in a sensible manner that takes account of the constant competition for power within human societies—albeit completely independent of the concept of “utility.”<sup>12</sup>

Regarding the roots of evolutionary anthropology in biology, now a first step towards a methodological integration has been achieved: on the formal level the dynamic view of social interaction implied by the relational concept of power is perfectly homologous to the Darwinian concept of “sexual selection” (Pianka, 1983, pp. 158ff.). This formal homology has already been elaborated on by Boyd and Richerson (1985, pp. 241ff.), who model Fisherian runaway processes on the level of culturally determined behavior. This is possible because sexual selection is in essence a social phenomenon too—depending, for example, on the social recognition of power relations between individuals. Hence, we might conclude that any social interaction centered around power relations leads to behavioral drives that may produce outright contradictions between adaptive fitness and reproductive success, ultimately hampering differential reproductive success of genes (Dawkins, 1989, pp. 304ff.). From that perspective, the alleged refutation of Darwinian approaches to human behavior, in particular by observation of the recent fertility decline in industrial societies (Radnitzky, 1987), loses much of its theoretical stringency (Alexander, 1988). Even if power in general might be supposed to contribute to differential reproductive success of individuals (Irons, 1979b; Betzig, 1986; Dunbar, 1988), this by no means implies that a temporary conflict between power goals and genetic reproduction or, the evolution of genetically and non-genetically transmitted rules, is impossible.<sup>13</sup> Furthermore, in that regard human behavior is no exception in the whole range of animal behavior.

**Propositional Set 3.** *In the long run, proximate power goals and their respective behavioral phenomena reproduce themselves if and only if they are not in conflict with the ultimate goal of the maximization of differential reproductive success of the individual. The information stored during genetic evolution and institutional evolution (resulting from social competition for power) is semantically congruent, i.e., non-contradictory, albeit not identical. The causal linkage between institutional and genetic evolution lies in the contribution of institutions to the solution of technical adaptive problems which in turn determine differential reproductive success. Especially: the institutional solutions of human societies coping with the perennial problem of scarcity of resources cannot stay in conflict with genetic evolution. Therefore, any measure for the distribution of economic resources—“wealth” in the broad sense—among the individuals of a certain population approximates a hypothetical measure of their respective propensity to reproduce, and any measure for the average availability of economic resources or wealth within a population as compared to other populations approximates a hypothetical measure of the respective average propensity to reproduce.*

Set Three is a highly complex argument presupposing considerable background knowledge. First of all, if the concept of “goal” is utilized, this is a mere shorthand for the more complex concept of “teleonomy” as contrasted to “teleology” (Rudolph & Tschohl, 1977, pp. 41, 95). Goals are not a given for evolutionary processes; they result from selective processes. This is valid even for the basic assumption of inclusive-fitness-maximization. Regarding the pivotal concept of “power,” power is not an absolute, external object of individual intentions but entirely the result of a competitive process during which individuals might not even know what the ultimate criterion of relative power status might be. Thus, evolutionary meaning or semantics is itself a result of evolution. This understanding is fundamental to the general biological usage of the concept of “fitness” (Küppers, 1986, pp. 195ff.), resulting in the conclusion that “fitness” as such cannot be the goal of individual behavior, whatever the specific meaning of “fitness” might be, given a certain context of selective pressures. Accordingly, the philosophic controversy over an alleged excessive reductionism (Koslowski, 1984) derives from a serious misunderstanding of teleonomic processes.

Furthermore, the internal structure of the Darwinian concept of “fitness” is very complex (Burian, 1983). At least, one has to draw a neat distinction between “technical” or “engineering fitness” in regard to the solution of adaptive problems, and “Darwinian” or “reproductive fitness” as reflected by the actual reproductive success of individuals as carriers of rules. To avoid tautological usages of the latter concept, the additional distinction between actual reproductive success and the hypothetical propensity to reproduce, given certain selective contexts, needs to be introduced. Hence, during any evolutionary process, although in the long run the evolutionary semantics of all of these fitness phenomena should concur, the continuously changing selective contexts result in a rather low probability of concurrence at any given point of time: Disequilibria occur between engineering and Darwinian fitness (as, e.g., in the case of sexual selection)<sup>14</sup>, and between actual reproductive success and the propensity to reproduce (the latter being a probabilistic concept). Hence, even in conventional biology no immediate answer to the problem of measuring fitness can be provided, especially regarding the relation between engineering fitness and the propensity to reproduce. The major research problem turns out to be the identification of appropriate indirect indicators of fitness (the well-known “currencies”) that are supposed to be observable and to represent a satisfying approximation of Darwinian fitness (Stephens & Krebs,



1986, pp. 3ff.). Given these difficulties, the problems in measuring fitness and identifying currencies in the case of humans lose much of their weight as an argument against evolutionary approaches to humanity because these problems are by no means specific to our species.

This observation has important implications for the integration of economics and biology. Within evolutionary considerations, there is no immediate need to refer to Darwinian fitness if sensible indirect fitness indicators can be discovered (Smith, 1983a). Since scarcity of resources is the main determinant of economic as well as evolutionary processes, we might be justified to suppose that every economic measure of resources reflecting scarcity, and accordingly, every economic measure of the availability of scarce resources (like wealth as measured by market prices), is closely related to hypothetical measures of Darwinian fitness. The main reason for this relationship is the fact that economic processes and the corresponding institutional structures solve problems of engineering fitness by coping with scarcity of resources. Of course, because of the existence of complex selective hierarchies, many intermediating variables between indirect fitness indicators are found in economics and Darwinian fitness. However, that situation is by no means different from respective analytical problems in the Darwinian perspective on animal behavior. This is especially valid in regard to the complex interaction between quantitative and qualitative dimensions of Darwinian fitness as reflected by the concepts of *r*- and *K*-selection (Pianka, 1983, pp.125ff.; Hansson & Stuart, 1990). Resource scarcity (including aspects like uncertainty of availability) is just one of the most important determinants of the relative weight of the quantitative and qualitative dimensions of reproduction. The higher the importance of the latter, the more complexity results in the hypothetical measurement of Darwinian fitness. Hence, nothing is astonishing in the fact that, in the case of humans, reproductive behavior as reflected for example in parental investment is determined by very complex selective hierarchies influencing the qualitative dimension of reproduction within social contexts (Sieff, 1990). One must at least distinguish between the effects of institutions governing the behavior of the members of one population as compared to another, and the effects resulting from the institutional framework of the competition for power (i.e., relative social positions) within a population.<sup>15</sup>

**Propositional Set 4.** *Proximate goals of individual actions are embedded within cognitive models of the physical and social environment that are in turn a part of the rules governing individual behavior. In particular, cognitive models carry information about institutions and their effects. In the long run, the evolution of cognitive models (qua rules) leads to an improving perception of contra-intuitive results of individual actions, given selective pressures from the physical and social environment.*

The pivotal role of cognitive models for human social interaction has been substantiated by ethnological research on the role of roundabout strategies for goal achievement in human behavior (Grammer, 1989). Such a utilization of roundabout solutions especially to social conflicts in the competition for power presupposes information about contra-intuitive results of individual actions, in view of the complex determinants of behavioral success within selective hierarchies. Presumably, this information cannot be conceived in totality within individual knowledge, and is carried by rules governing behavior (Hayek, 1979, pp. 153ff.). Thus, following Rappaport (1979), evolutionary anthropology has to distinguish, on the one hand, between the teleonomy of the selective process that determines successful solutions of adaptive challenges, and the endogenous teleonomy of human cognitive models on the other hand.

Over time, the two types of teleonomic processes need to concur if individual behavior is to be adaptive. However, because of the difference between individual knowledge and information actually carried by rules and cognitive models, individual knowledge as embedded in cognitive models is not necessarily “true” in the sense of the correspondence theory of truth (contrary to the presumption of standard evolutionary epistemology found in, e.g., Bartley, 1987; Vollmer, 1987). Even objectively false models (like certain religious belief systems) can be adaptive if they lead to unintended positive adaptive consequences of the resulting individual behavior (e.g., totemism might foster reasonable utilization of environmental resources). Hence, the concept of truth underlying the analysis of evolutionary semantics in general and of cognitive models in particular is a systemic and pragmatic one (Rescher, 1973, pp.238ff., 1979; Bateson, 1979). Ultimately, the concept of “fitness” cannot be interpreted independently of the selective heterarchies into which even the behavior of the scientific observer is woven.

Moreover, Set 4 makes obvious why power maximizing behavior needs much time (as measured in human generations) to evolve into sophisticated strategies like “enlightened despotism” (Betzig, 1986, pp. 99ff.). On the other hand, the more sophisticated these implicit or explicit strategies, the more difficult, though not invalid, the Darwinian analysis.

**Propositional Set 5.** *Within a population, power hierarchies are stable if and only if individual strategies for the achievement of proximate power goals give rise to either intended or unintended side-effects resulting in the solution of “prisoners’ dilemmas,” free-rider problems, etc., that hamper the production of public goods. Production of public goods leads to an improvement of solutions of adaptive problems that confront the whole population. Although this does not lead to changes in the internal power relations within a population, its relative power status as compared to other populations increases by the production of public goods. The specific form of side effects is especially determined by the cognitive models governing the individual behavioral strategies. The evolution of cognitive models leads to a gradual transformation of unintended into intended side effects.*

Closely related to Set 2, Set 5 identifies the most important condition fostering temporary stability of inherently instable power relations. This condition is valid independently of the state of knowledge of the individuals concerned. Production of public goods (e.g., in the case of the ideal-typical hydraulic despotism) gives rise to a phenomenon analogous to so-called “phylogenetic ratcheting” in natural selection (Reed, 1979, pp. 879ff.; Bonner, 1988, p. 66). For instance, production of public goods fosters population growth leading to an ecological situation where return to the former state is not possible without a serious decline in the propensity to reproduce for every member of a population.<sup>16</sup> The only stable solution is the continuous reproduction of the higher degree of social complexity implied in the production of public goods. This is the main reason why, in different attempts to measure societal complexity, more attention usually has been paid to political organization than to economic organization in the narrow sense (Alexander, 1979, pp. 249ff.; Corning, 1983, pp. 350ff.; Claessen & Velde, 1985).

The stabilization of power hierarchies by means of production of public goods is no probable event. The historical record suffers from the distortion that results from the fact that failures in stabilization simply disappear from the stage of history (Tilly, 1975a). Even small groups as elementary as the human reproductive dyad are constantly at risk to break down because of reproductive conflicts well-known in behavioral ecology (Krebs & Davies, 1987, pp. 161ff.): There is only a low probability that the production of the respective public goods

(like economies of scale in consumption or higher productivity by means of specialization) can be organized without power hierarchies.<sup>17</sup> In a similar vein, the development of states was always seriously hampered when at the outset no considerable power differences between the organizers and the individuals being organized existed. Typically, states could not be stabilized by means of a redistribution of wealth aiming at mutual consent between individuals with a similar power status (Hodges, 1982; Claessen, 1985; Claessen & Velde, 1985).

On a theoretical level, the considerable impediments during the development of more complex societal structures that contribute to the solution of adaptive challenges can be reduced to the general pattern of the “specialization dilemma” (Kliemt, 1988). Specialization dilemmas occur when contracts are inherently unstable because the parties have incentives to break arrangements concerning division of labor, given greater bargaining power for one party if the other actually tries to fulfill the obligations. The standard situation in economic life is that specialization leads to different degrees of asset specificity on the part of the different contractual parties who invest in a cooperative relationship (Alchian, 1984). During the evolution of political and economic institutions, a similar situation occurs when different groups in society specialize in either production or the military (Hicks, 1969, pp. 101ff.). Such specialization makes possible more efficient production of public goods (territorial defense); but after the process of specialization has concluded, the holders of military power have strong incentives to further maximize their power via appropriation of the total surplus of production. Hence, political development takes place under constant danger of economic decline because of the resulting disincentives for production (North, 1981; Jones, 1988). During real historical processes as well as theoretically, specialization dilemmas are resolved by the evolution of complex power hierarchies establishing a third party capable of enforcing the implicit specialization contract, as, e.g., in the transition from feudalism to absolutism (Gintis & Bowles, 1984).<sup>18</sup>

**Propositional Set 6.** *If stable power hierarchies have been established—within a population—that contribute to the production of public goods, an outside observer is induced to perceive phenomena of group selection and competition between groups. As a rule, on the population level these power hierarchies are accompanied by the propagation of cognitive models that provide cues for demarcating this population in contrast to other populations. In most cases, such types of cognitive models evolve in populations which are reproductively integrated in a degree higher than that of hypothetical populations sampled randomly.*

Outside of biology, group selection plays a decisive role in Hayek’s theory of societal evolution (Radnitzky, 1987). From the viewpoint of Darwinism, the concept of group selection remains highly elusive, although the issue has not been settled definitively (Dyson-Hudson, 1983; Melotti, 1987). Therefore, Set 6 proposes treating group selection as an observational category without attributing an explanatory function in the sense of identification of ultimate causes. Nonetheless, if populations are delimited according to the scope of the respective public goods produced, group selection might achieve the status of a sensible theoretical term. In that case, the concept of population turns out to be a theoretical term too, especially if a relation to the biological term of “species” is established (Abruzzi, 1982). Whereas proper populations qua species are delimited in biology by means of concepts like “reproductive isolation” (Mayr, 1983, pp. 273ff.), evolutionary anthropology needs to develop more sophisticated concepts to deal with evolving units below the species level, resulting

from complex interaction between different levels of selective heterarchies including interaction between genetically and non-genetically transmitted rules.

But note that such a perspective by no means precludes the possibility that in fact human institutions in general serve to demarcate reproductively more closely integrated populations (Freedman, 1979, pp. 131ff.; Irwin, 1987).<sup>19</sup> In principle, every behavior contributing to the goal of inclusive fitness maximization needs to solve the problem of how to distinguish between different degrees of genetic closeness between individuals. However, like cognitive models, these solutions might not be true, and might evolve on their part. In the case of humans, systems of kinship can provide relevant clues (which, of course, are in turn not determined by genetics). In more complex stages of societal evolution, other types of cognitive models appear, encompassing larger populations integrated by power hierarchies and the respective production by public goods. Typically, phenomena like ethnicity, ethnocentrism, and myths of descent are related to reproductively integrated populations, in the long term at least. Eventually, they even contribute to the genesis and stabilization of modern political systems like the nation state (Smith, 1986; Elwert, 1989). Guided by these cognitive models, individuals are ready to sacrifice their personal life for the “common cause”—thereby lowering the costs of military mobilization as a public “good,” making warfare possible in new dimensions of cruelty and mass participation (Finer, 1975), and leading to new dimensions of group selection including genocide. The obvious long-range evolutionary stability of phenomena like ethnicity can be explained only in light of the ultimate concurrence of comparatively high degrees of reproductive integration and comparatively high internal mobility in the same population. Ethnicity becomes an indicator of possible genetic closeness, without in its specific forms being genetically fixed,<sup>20</sup> or even corresponding to real genetic differences.

**Propositional Set 7.** *The evolution of the state is an unintended consequence of conflicts among individual strategies to achieve power, starting from the organization of groups along the lines of kinship as perceived through cognitive models. The specific historical development of different states is driven by the interaction between military technology, including the social organization of military activities; the ecological productivity of the territory, given a certain level of technology; and the way that economic resources are appropriated for military purposes.*

**Propositional Set 8.** *The evolution of economic institutions is a side-effect of specific strategies of power holders or states for appropriation of resources for military purposes. The resulting institutional regimes are globally efficient, if, either intended or unintended, the resources actually are utilized for the production of public goods. Whether this is the case can be perceived only by observing the results of group selection. If so, there can be supposed to exist a non-contradictory relation between proximate and ultimate goals on different levels of selective heterarchies. Global efficiency can be measured by means of indicators of individual adaptive success. Some possible indicators are:*

- *population density as an indicator of the ecological productivity of a territory resulting from the institutions governing the behavior of the individuals of the inhabiting population (Rappaport, 1979),*
- *changes of the population growth rate, serving as an approximation for measuring successful solutions of adaptive problems at very least (Simon, 1990), perhaps also of the individual propensity to reproduce,<sup>21</sup>*

- *indicators of physical and mental health, and their changes* (Corning, 1983, pp. 172ff.),
- *changes in the role of physical force in determining mortality* (Knauff, 1987),
- *the distribution of wealth among populations,*
- *the relation between the growth of the state sector and the growth of production.*

Sets 7 and 8 establish the crucial empirical link between evolutionary theory and the economic explanation of institutional change.<sup>22</sup> As we have seen, the essential elements in this chain of reasoning are the concepts of power, of adaptation in the sense of the distinction between engineering and Darwinian fitness, of unintended consequences of power strategies, and of public goods. The sets need no further comment since similar hypotheses have already been proposed by historians, economists, and anthropologists such as Ardant (1975), North (1981), Brumfiel (1984), Rosenberg and Birdzell (1986), and Jones (1988), albeit sometimes with a one-sided stress on the role of taxation, with insufficient attention to the purposes of taxation. Most of these scholars completely disregard the issue of global efficiency.

Sets 7 and 8 are more important for the organization of empirical research than for the theoretical foundation of evolutionary anthropology. However, the mentioned phenomena are supposed to render the interaction between biological and economic processes observable.

#### 4. Future Tasks for Empirical Research

Starting from Sets 7 and 8, we can identify many tasks for future research. The scientific value of hypotheses is determined by their capacity to raise further questions. I merely want to list several important topics.

##### (a) *How is long-term societal evolution shaped by the underlying kinship systems?*

Note that the distribution of different types of political and economic organization in the world shows a remarkable congruity with the distribution of different types of family structures and kinship systems (Todd, 1983). Furthermore, the ecological determinants of economic development are heavily influenced by the effects of population growth, which on its part is determined at least partly by reproductive norms implied in kinship systems. For instance, the "modern" model of the European-Christian family was, in fact, no necessary by-product of industrialization, and rather goes back to the early influence of the Church, triggered by conflicts over territorial resources and power during the first millennium (Goody, 1983). This peculiar type of a family structure gave rise to a specifically European demographic profile (resulting, e.g., from late marriage, primogeniture, etc.) (Tilly, 1975a) which set a completely different ecological framework for economic development as compared to other regions in the world.

##### (b) *How do the ecological and technological determinants of warfare lead to particular forms of political organization, eventually stabilizing culture-specific structures of power and their respective cognitive models?*

For instance, in comparisons of China and Europe the most fundamental developmental difference might consist in the contrast between the Chinese unitary state on the one hand and the European state system on the other (Bünger, 1987). The diverging political evolution was accompanied by the long-term stabilization of peculiar societal power structures with, e.g., a

considerably diverging importance of formal rules as contrasted to informal social control through local groups (Shue, 1988; Herrmann-Pillath, 1990b). Until recently, the Chinese unitary state was stabilized by cultural preferences for a strong center, without any predominantly nationalistic drive in the European sense leading to the accentuation of differences between populations controlled by different centers (Fairbank, 1987; Bastid, 1987; Cohen, 1988; Tilly, 1975a). However, the unitary state evolved as a means to cope with certain problems of environmental control (solving, e.g., the free-rider problem arising during the organization of flood control), and in response to the effects of military competition, given different degrees of population density and different military technologies such as those prevailing in Europe (Elvin, 1973, pp. 1ff.; Finer, 1975). Today, the resulting power structures in China show considerable resistance to change and have been diagnosed to be major impediment for reform (Herrmann-Pillath, 1990a).

*(c) How do ecological consequences of certain power structures and their effects on the production of public goods result in peculiar paths of economic development, thereby influencing outcomes of military competition between populations, and changes in individual adaptive, perhaps reproductive, success?*

The historical record shows many instances of a close interaction between political development and, for example, demographic change, resulting in differences in military competitiveness between populations. Well-known examples, of course, are the decline of the Roman Empire as well as the diverging success of European states during the transition to absolutism (Anderson, 1974). These observations lend themselves to an attempted reconstruction in terms of evolutionary anthropology utilizing indicators of adaptive success. The most important linkage to economic analysis is established by analysis of the effects of political action on the internalization of ecological costs of individual economic decision making.

*(d) How does ecology shape long-term economic development and institutional change, given certain degrees of internalization of ecological costs in individual decision making?*

The classical hypothesis of "hydraulic despotism" was a first proposal linking ecology and economic development as determined by institutions governing the production of public goods. More sophisticated versions of such an argument might start from the observation that, given different social structures and different levels of economic development and types of technology available, the production of essentially the same amount of the public good (like flood control) needs to be organized in different ways and, above all, with different amounts and types of capital available. For instance, on a low level of economic development the surplus to be extracted from the economy triggers considerable disincentives for growth in the private sector. However, there are more promising fields of research. For instance, the seminal theory proposed by Hesse (1982) explains the Industrial Revolution in Europe as an unintended consequence of adaptive strategies of peasants coping with peculiar climatic conditions. These conditions are supposed to have acted as order parameters that determined the incentives for the formation of capital by labor, for intensification of land-utilization, and for investment in labor-saving technology. The latter in turn determined the decisive role of demand for small-scale capital goods in the Industrial Revolution. This approach lends itself easily to a synthesis with the above mentioned theory proposed by Elvin (1973), who explains China's failure to industrialize as due to ecological determinants, e.g., the opportunity costs of capital formation. On the other hand, Wright (1990) was able to demonstrate that endowment with natural resources (which, of course, is in turn endogenous to technological change) was a decisive force driving the rapid industrialization in the United

States. As Hansson and Stuart (1990) have demonstrated recently, ecological determinants might even influence preferences that guide the inter-generational transfer of resources that eventually determines the growth rate and the capital stock of an economy. Thus, a completely new approach to development problems, rooted in evolutionary anthropology, may already be discernible, and may address questions still unanswered in development economics (Landes, 1990).

Many other research topics could be hinted at, for instance, in the field of economics of the family, demography, the analysis of social change, the theory of preference formation, and so on. In most cases, evolutionary anthropology need not discover new facts, but look at known facts from a new perspective. Hence, a Darwinian framework for the economic analysis of institutional change in history as well as in other fields of the social sciences has a high probability of producing a rapidly growing body of knowledge concerning biological aspects of human existence. The most important precondition for the realization of the opportunities offered lies in preparedness and openness for interdisciplinary discourse.

### Notes

1. Of course, such an argument is put forward not only by economists but plays a crucial role within the anthropological controversy about the methodological soundness of Darwinian approaches to human behavior. For instance, during recent discussion about factors determining the secondary sex ratio in human populations, Darwinian approaches were criticized by requests for the relevant genetic foundation for behavioral differences of individual reproductive behavior, in particular parental investment (Sieff, 1990; Fix, 1990).
2. For instance, within models of dissipative structures the Lotka-Volterra equations are generalized (Seifritz et al., 1989). Note that methodologically a clear-cut distinction between mathematical structures, models resulting from the specification of structures, and the empirical application of models is needed (Stegmüller, 1986; Marggraf, 1989).
3. This paper is a quite bold statement of the research program underlying a much larger study in German the author expects to conclude in 1992, under the heading "Regeln, Anpassung und Zufall: Ein ökonomisch-philosophischer Versuch über die evolutionstheoretische Synthese der Humanwissenschaften."
4. However, in a very stimulating paper, Konrad (1990) has demonstrated that starting from the analysis of status preferences as scrutinized by Frank (1985) there is a possibility of establishing an immediate link between the explanation of certain general types of preferences and Darwinian approaches to human behavior.
5. For a more general theoretical perspective on the possible role of power for economic analysis, see Bartlett (1988). Later on, we shall see how such an approach establishes an immediate link to evolutionary approaches.
6. Of course, the argument proceeds very sketchily. At very least, the influence of organizational problems and organizational decline should be considered in more detail (Jones & Kuhn, 1985).
7. Aside from the case of imperial China, many other examples in history might serve to demonstrate the difficulties arising especially during the comparative assessment of military and economic efficiency. Very instructive are the cases of Eastern Rome and Byzantium as compared to Western Europe, where military success was precisely what ultimately led to economic decline because of the negative impact of the fiscal system on incentives for growth (Böhme, 1979, pp. 71ff.); and Russia, where the organization of the military, given the challenges for instance resulting from invading nomadic populations, was one of the determinants obstructing the evolution of a market economy (White, 1987).
8. Curiously, Dawkins' approach might be more acceptable via critiques of sociobiology rooted

in cultural anthropology, as, e.g., put forward by Sahlins. This possible relationship has already been analyzed by Boyd and Richerson (1985, pp. 271ff.).

9. Most discussions about the methodological extensions of Darwinism do not pay enough attention to the problem of evolutionary semantics, which turns out to be the crucial albeit still unresolved issue in synergistic modelling of evolution (Küppers, 1986, pp. 61ff., 195ff.; Haken & Haken-Krell, 1989, pp. 50ff.).

10. Again, this idea is rooted in biology proper, where after Campbell's (1973) seminal discussion of "downward causation" a "systems theory" of evolution has been developed which assumes that the results of evolution are determined by selective processes on different hierarchical levels, as in, e.g., selection within organisms as opposed to selective pressures of the environment (Wuketits, 1987; Bonner, 1988).

11. From different perspectives this problem has been analyzed by economists like Schelling (1979) and Frank (1985). In particular, many hypotheses of economics have to be changed considerably if goods are to be regarded as positional goods which derive their utility for the consumer out of the effects of consumption on the relative social status.

12. I can only hint at the fact that the theoretical foundation of such a perspective on human social and economic behavior has already been established in the first chapter of Max Weber's *Wirtschaft und Gesellschaft* (Economy and Society) (1922/1985).

13. Furthermore, the complexity of societal power relations makes a clear-cut interpretation in terms of reproductive success difficult. For instance, Moore (1990) recently criticized Chagnon's hypothesis that more aggressive human males might achieve higher differential reproductive success in societies where war plays an important role. His example is the obviously low reproductive success of Cheyenne war chiefs as opposed to peace chiefs. However, careful reading of his account makes one realize that the underlying power relations between war chiefs (mostly poor, socially isolated individuals like orphans) and peace chiefs (mostly coming from large extended families of high social status)—not the individual behavioral phenomena caused by such power relations—is the real issue at stake for evolutionary anthropology.

14. In the new edition of *The Selfish Gene*, Dawkins (1989, pp. 304ff.) even puts forward the conjecture that these disequilibria are the normal state of natural selection—so that the whole foundation of the Darwinian argument would have to be changed.

15. In this regard, remarkable studies have been conducted by Boone (1983; 1988), Hayden (1986), Voland (1988), Crook & Crook (1988), and others who succeeded in demonstrating the close interaction among resource characteristics, institutions, competition for relative social positions, and reproductive behavior as reflected in family structures and demographic developments—without succumbing to an excessive sociobiological reductionism.

16. Again, the almost ideal-typical classic example is the dynastic cycle in traditional China (Herrmann-Pillath, 1989).

17. This problem might be one of the most promising fields of research within a synthesis of biology and economics (Quiatt & Kelso, 1985; Osche, 1987; Pateman, 1989; Galler & Ott, 1990). This is particularly valid if aspects of the emotional foundations of behavior are considered as well, where functional equivalents to power relations exist that furthermore are culture-specific (Frank, 1988).

18. Therefore, Corning (1983) concludes that functional synergism can be stabilized only within complex political systems.

19. The recent heated discussion about the attempts of Cavalli-Sforza et al. to establish a relationship between human genetic evolution and language evolution is a case in point (Bateman et al., 1990). Such hypotheses constantly meet sharp criticism because of the alleged racist implications (Rose et al., 1984, pp. 119ff.). From the perspective of evolutionary anthropology, this is a serious misunderstanding, because genetic differences are no precondition for the evolution of behavioral clues demarcating reproductively closer integrated populations that can be characterized by a common public good. As in general biology (Hasenfuss, 1987), the argument proceeds quite the other way round: there might



be a distant possibility that behavioral differences between populations ultimately lead to genetic differences. Because of the high mobility of humans, however, this possibility presumably has never or only in a very low degree been realized. Nevertheless, this does not mean that no behavioral demarcations between populations are produced and reproduced.

20. Although the general drive to ethnicity is genetically fixed, presumably (Vine, 1987; Flohr, 1987). Again, these observations have to be related to Frank's (1988) discussion of emotions.

21. A further remark concerning modern fertility decline seems appropriate. Whether or not observed fertility decline actually mirrors decreasing reproductive success in Darwinian terms can be assessed only if the qualitative dimension of reproduction is scrutinized very carefully. In the case of industrial societies, economic theories of fertility decline are precisely what can be interpreted in Darwinian terms. For instance, if fertility is reduced because of the growing net-transfer of wealth to children for rearing, this might reflect the very high costs in terms of human capital that must be incurred in running the complex adaptive processes of industrial societies. Furthermore, an unintended side-effect of power processes in society resulting from consumption of positional goods might be an ecologically adaptive fertility decline, given the complex requirements of utilization of technology. Last but not least, nothing precludes the possibility that fertility decline is an instance of a divergence between engineering and Darwinian fitness.

22. For lack of space, the corresponding critique of alternative economic theories will be elaborated on in another place (Herrmann-Pillath, 1991).

## References

- Abruzzi, W. S. (1982) "Ecological Theory and Ethnic Differentiation Among Human Populations." *Current Anthropology*, 23, 13-35.
- Alchian, A. A. (1984) "Specificity, Specialization, and Coalitions." *Journal of Institutional and Theoretical Economics*, 140, 34-49.
- Alexander, R. D. (1979) *Darwinism and Human Affairs*. Seattle, WA: University of Washington Press.
- Alexander, R. D. (1988) "Evolutionary Approaches to Human Behavior: What Does the Future Hold?," in Betzig et al., pp. 317-341.
- Anderson, P. (1974) *Lineages of the Absolutist State*. London: Verso.
- Ardant, G. (1975) "Financial Policy and Economic Infrastructure of Modern States and Nations," in Tilly, 1975b, pp. 164-242.
- Ayala, F. J. & Dobzhansky, T., eds. (1974) *Studies in the Philosophy of Biology*. Berkeley, CA: University of California Press.
- Bargatzky, T. (1984) "Culture, Environment, and the Ills of Adaptationism." *Current Anthropology*, 25, 399-415.
- Bartlett, R. (1989) *Economics and Power*. Cambridge, UK: Cambridge University Press.
- Bartley, III, W. W. (1987) "Philosophy of Biology versus Philosophy of Physics," in Radnitzky & Bartley, pp. 7-46.
- Bateman, R., Goddard, I., O'Grady, R., Funk, V. A., Mooi, R., Kress, W.J., & Cannell, P. (1990) "Speaking of Forked Tongues: The Feasibility of Reconciling Human Phylogeny and the History of Language" *Current Anthropology*, 31, 1-24.
- Bateson, G. (1979) *Mind and Nature. A Necessary Unity*. London: Wildwood.
- Betzig, L. (1986) *Despotism and Differential Reproduction: A Darwinian View of History*. New York: Aldine.
- Betzig, L., Bergerhoff Mulder, M., & Turke, P., eds. (1988) *Human Reproductive Behavior. A Darwinian Perspective*. Cambridge, UK: Cambridge University Press.
- Binger, B. R. & Hoffman, E. (1989) "Institutional Persistence and Change: The Question of Efficiency." *Journal of Institutional and Theoretical Economics*, 145, 67-84.

- Böhme, H. (1977): *Morgenland und Abendland, Europäische Wirtschafts- und Sozialgeschichte, Band 1*. Frankfurt: Fischer.
- Bonner, J. T. (1988) *The Evolution of Complexity by Means of Natural Selection*. Princeton, NJ: Princeton University Press.
- Boone, J. T. (1983) "Noble Family Structure and Expansionist Warfare in the Middle Ages: A Socioecological Approach," in Dyson-Hudson & Little, pp. 79–96.
- Boone, J. T. (1988) "Parental Investment, Social Subordination and Population Processes Among the 15th and 16th Century Portuguese Nobility," in Betzig et al., pp. 201–220.
- Boyd, R. & Richerson, P. (1985) *Culture and the Evolutionary Process*. Chicago: University of Chicago Press.
- Braun, R. (1975) "Taxation, Sociopolitical Structure, and State-Building: Great Britain and Brandenburg-Prussia," in Tilly, 1975b, pp. 243–328.
- Bright, C. & Harding, S., eds. (1984) *Statemaking and Social Movements*. Ann Arbor, MI: Michigan University Press.
- Brooks, M. A., Heijdra, B. J., & Lowenberg, A. (1990) "Productive versus Unproductive Labour and Rent Seeking: Lessons From History." *Journal of Institutional and Theoretical Economics*, 146, 419–438.
- Brumfiel, E. (1984) "Aztec Statemaking, Ecology, Structure and the Origin of the State," in Bright & Harding, pp. 52–81.
- Bunge, M. (1980) *The Mind-Body Problem, A Psychobiological Approach*. New York: Pergamon.
- Büniger, K. (1987) "Concluding Remarks on Two Aspects of the Chinese Unitary State as Compared with the European State System," in Schram, pp. 313–324.
- Burian, R. M. (1983) "Adaptation," in Grene, pp. 287–314.
- Cambel, A., Fritsch, B., Keller, J. U., eds. (1989) *Dissipative Strukturen in integrierten Systemen*. Baden-Baden: Nomos.
- Campbell, D. T. (1974) "Downward Causation' in Hierarchically Organized Biological Systems," in Ayala & Dobzhansky, pp. 179–186.
- Chagnon, N. & Irons, W., eds. (1979) *Evolutionary Biology and Human Social Behavior, an Anthropological Perspective*. North Scituate: Duxbury.
- Claessen, H. J. M. (1985) "From the Franks to France—The Evolution of a Political Organization," in Claessen et al., pp. 196–218.
- Claessen, H. J. M. & Velde, P. v. d. (1985) "Sociopolitical Evolution as Complex Interaction," in Claessen et al., pp. 246–263.
- Claessen, H. J. M., Velde, P. v. d., & Smith, M. E., eds. (1985) *Development and Decline. The Evolution of Sociopolitical Organization*. Boston, MA: Bergin and Garvey.
- Cohen, P. A. (1988) "The Post-Mao Reforms in Historical Perspective." *The Journal of Asian Studies*, 47, 518–540.
- Coming, P. A. (1983) *The Synergism Hypothesis. A Theory of Progressive Evolution*. New York: McGraw-Hill.
- Crook, J. H. & Crook, S. J. (1988) "Tibetan Polyandry: Problems of Adaptation and Fitness," in Betzig et al., pp. 97–114.
- Dawkins, R. (1989) *The Selfish Gene*, 2nd Edition. Oxford: Oxford University Press.
- Delius, J. D. (1989) "Of Mind, Memes and Brain Bugs, a Natural History of Culture," in Koch, pp. 26–79.
- Dunbar, R. I. M. (1987) "Sociobiological Explanations and the Evolution of Ethnocentrism," in Reynolds et al., pp. 48–59.
- Dunbar, R. I. M. (1988) "Darwinizing Man. A Commentary," in Betzig et al., pp. 161–173.
- Durham, W. H. (1979) "Towards a Coevolutionary Theory of Human Biology and Culture," in Chagnon & Irons, pp. 39–59.
- Dyson-Hudson, R. (1983) "An Interactive Model of Human Biological and Behavioral Adaptation," in Dyson-Hudson & Little, pp. 1–22.

- Dyson-Hudson, R. & Little, M. A., eds. (1983) *Rethinking Human Adaptation: Biological and Cultural Models*. Boulder, CO: Westview.
- Elvin, M. (1973) *The Pattern of the Chinese Past*. Stanford, CA: Stanford University Press.
- Elwert, G. (1989) "Nationalismus und Ethnizität. Über die Bildung von Wir-Gruppen," *Kölnher Zeitschrift für Soziologie und Sozialpsychologie*, 41, 440–464.
- Fairbank, J. K. (1987) "The Reunification of China." *The Cambridge History of China*, 14(1), 1–47.
- Felderer, B., ed. (1990) *Bevölkerung und Wirtschaft. Jahrestagung des "Vereins für Sozialpolitik" 1989*. Berlin: Duncker & Humblot.
- Findlay, C. S. & Lumsden, C. J. (1989) "Culture and the Creative Process: A Gene-Culture Perspective," in Koch, pp. 420–441.
- Finer, S. E. (1975) "State- and Nation-Building in Europe: The Role of the Military," in Tilly, 1975b, pp. 84–163.
- Fix, A. G. (1990) "Comment on Sieff," *Current Anthropology*, 31, 36–37.
- Frank, R. K. (1985) *Choosing the Right Pond*. Oxford: Oxford University Press.
- Frank, R. H. (1988) *Passions Within Reason. The Strategic Role of Emotions*. New York: Norton.
- Freedman, D. G. (1979) *Human Sociobiology*. New York: Free Press.
- Freye, H.-A. (1986) *Humanökologie für Mediziner und Biologen*. Wiesbaden: Quelle & Meyer.
- Furubotn, E. (1989) "Distributional Issues in Contracting for Property Rights, Comment," *Journal of Institutional and Theoretical Economics*, 145, 25–31.
- Galler, H. P. & Ott, N. (1990) "Zur Bedeutung familienpolitischer Maßnahmen für die Familienbildung," in Felderer, (in press).
- Gintis, H. & Bowles S. (1984) "State and Class in European Feudalism," in Bright & Harding, pp. 19–52.
- Grammer, K. (1989) *Biologische Grundlagen des Sozialverhaltens*. Darmstadt: Wissenschaftliche Buchgesellschaft.
- Grene, M., ed. (1983) *Dimensions of Darwinism*. Cambridge, UK: Cambridge University Press.
- Gudeman, S. (1986) *Economics as Culture. Models and Metaphors of Livelihood*. London: Routledge.
- Gutmann, G. & Schüller, A., eds. (1989) *Ethik und Ordnungsfragen der Wirtschaft*. Baden-Baden: Nomos.
- Haken, H. (1983) *Synergetics*. Berlin: Springer.
- Haken, H. & Haken-Krell, M. (1989) *Entstehung von biologischer Information und Ordnung*. Darmstadt: Wissenschaftliche Buchgesellschaft.
- Handwerker, W. P., ed. (1986) *Culture and Reproduction. A Critique of Demographic Transition Theory*. Boulder, CO: Westview.
- Hansson, I. & Stuart, C. (1990) "Malthusian Selection of Preferences." *American Economic Review*, June, 529–544.
- Harris, M. (1979) *Cultural Materialism*. New York: Random House.
- Hasenfuss, I. (1987) "Tiergeographie und Evolution," in Siewing, pp. 305–326.
- Hayden, B. (1986) "Resources, Rivalry, and Reproduction: The Influence of Basic Resource Characteristics on Reproductive Behavior," in Handwerker, pp. 176–195.
- Hayek, F. A. (1979) *Law, Legislation, and Liberty. Vol. III*. Chicago: University of Chicago Press.
- Heilbroner, R. H. (1987) "Wealth." *The New Palgrave*, 4, 880–882.
- Herrmann-Pillath, C. (1989) "Die konfuzianische Synthese: Wirtschaftspolitische Konzepte und normative Grundlagen gesellschaftlicher Ordnung als anpassungsoptimierende evolutorische Strategien," in Gutmann & Schüller, pp. 195–228.
- Herrmann-Pillath, C. (1990a) *China—Kultur und Wirtschaftsordnung*. Stuttgart: G. Fischer.
- Herrmann-Pillath, C. (1990b) "Die humanevolutorische Rahmentheorie der Institutionenökonomik: Erste Basishypothesen und komparative Beobachtungen zur Entwicklung des Staates in China und Europa." Paper presented to the Session of the Arbeitskreis "Evolutorische Ökonomik" of the Verein für Sozialpolitik in Freiburg.
- Herrmann-Pillath, C. (1991) "Der Vergleich von Wirtschafts- und Gesellschaftssystemen: Wissen-

- schaftsphilosophische und methodologische Betrachtungen zur Zukunft eines ordnungstheoretischen Forschungsprogrammes." *ORDO*, 42, 3–55.
- Hicks, J. R. (1969) *A Theory of Economic History*. Oxford: Oxford University Press.
- Hodges, R. (1982) *Dark Age Economics*. London: Duckworth.
- Hoffmann, P. T. (1989) "Institutions and Agriculture in Old-Régime France." *Journal of Institutional and Theoretical Economics*, 145, 166–182.
- Irons, W. (1979a) "Natural Selection, Adaptation, and Human Social Behavior," in Chagnon & Irons, pp. 4–39.
- Irons, W. (1979b) "Cultural and Biological Success," in Chagnon & Irons, pp. 257–273.
- Irwin, C. J. (1987) "A Study in the Evolution of Ethnocentrism," in Reynolds et al., pp. 131–156.
- Jones, E. R. (1988) *Growth Recurring*. Oxford: Clarendon.
- Jones, S. M. & Kuhn, P. A. (1985) "Dynastic Decline and the Roots of Rebellion." *The Cambridge History of China*, 10(1), 107–162.
- Kliemt, H. (1985) *Moralische Institutionen. Empiristische Theorien ihrer Evolution*. München: Alber.
- Kliemt, H. (1988) "The Cost of Organizing Social Cooperation—Some Remarks About the Game of Creating a Game." Unpublished paper.
- Knauff, B. M. (1987) "Reconsidering Violence in Simple Human Societies." *Current Anthropology*, 28, 457–500.
- Koch, W. A., ed. (1989) *The Nature of Culture*. Bochum: Brockmeyer.
- Konrad, K. A. (1990) "Statuspräferenzen: Soziobiologische Ursachen, Statuswettrüsten und seine Besteuerung," *Kyklos*, 43, 249–272.
- Koslowski, P. (1984) *Evolution und Gesellschaft*. Tübingen: Mohr.
- Kowalewski, S. A. & Finsten, L. (1983) "The Economic Systems of Ancient Oaxaca: A Regional Perspective." *Current Anthropology* 24, 413–441.
- Krebs, J. R. & Davies, N. B. (1987) *An Introduction to Behavioral Ecology*. Oxford: Blackwell.
- Küppers, B.-O. (1986) *Der Ursprung biologischer Information. Zur Naturphilosophie der Lebensentstehung*. München: Piper.
- Landes, D. S. (1990) "Why Are We So Rich and They So Poor?" *American Economic Review*, May, 1–13.
- Libecap, G. D. (1989) "Distributional Issues in Contracting for Property Rights." *Journal of Institutional and Theoretical Economics*, 145, 6–24.
- Lumsden, C. J. & Wilson, E. O. (1981) *Genes, Mind, and Culture*. Cambridge, MA: Harvard University Press.
- Marggraf, R. (1989) "Von nicht-linearen ökonomischen Strukturen zu nicht-linearen ökonomischen Modellen," in Cambel et al., pp. 223–238.
- Mayr, E. (1983) *The Growth of Biological Thought*. Cambridge, MA: Belknap.
- Melotti, U. (1987) "In-Group/Out-Group Relations and the Issue of Group Selection," in Reynolds et al., pp. 94–112.
- Moore, J. H. (1990) "The Reproductive Success of Cheyenne War Chiefs: A Contrary Case to Chagnon's Yanomamö." *Current Anthropology*, 31, 322–330.
- Nelson, R. R. & Winter, S. G. (1982) *An Evolutionary Theory of Economic Change*. Cambridge, MA: Belknap.
- North, D. C. (1981) *Structure and Change in Economic History*. New York: Norton.
- North, D. C. (1989) "A Transaction Cost Approach to the Historical Development of Politics and Economics." *Journal of Institutional and Theoretical Economics*, 145, 661–668.
- Osche, G. (1987) "Die Sonderstellung des Menschen aus biologischer Sicht: Biologische und kulturelle Evolution," in Stewing, 499–524.
- Osterhammel, Jürgen (1989) *China und die Weltgesellschaft*. München: Hanser.
- Pateman, C. (1989): "'God Hath Ordained Man a Helper': Hobbes, Patriarchy, and Conjugal Right." *British Journal of Political Science*, 19, 445–464.

- Pianka, E. R. (1983) *Evolutionary Ecology*. New York: Harper & Row.
- Quiatt, D. & Kelso, J. (1985) "Household Economics and Hominid Origins." *Current Anthropology*, 26, 207–222.
- Radnitzky, G. (1987) "An Economic Theory of the Rise of Civilization and Its Policy Implications: Hayek's Account Generalized." *ORDO*, 38, 47–90.
- Radnitzky, G. & Bartley, W. W., eds. (1987) *Evolutionary Epistemology, Rationality, and the Sociology of Knowledge*. La Salle, IL: Open Court.
- Rappaport, R. A. (1979) *Ecology, Meaning, and Religion*. Richmond, CA: North Atlantic.
- Reed, C. A. (1977a) "Origins of Agriculture: Discussion and Some Conclusions," in Reed, 1977b, pp. 879–956.
- Reed, C. A., ed. (1977b) *Origins of Agriculture*. The Hague: Mouton.
- Rescher, N. (1973) *The Coherence Theory of Truth*. Oxford: Clarendon.
- Rescher, N. (1979) *Cognitive Systematization*. Oxford: Blackwell.
- Reynolds, V., Falger, V., & Vine, I., eds. (1987) *The Sociobiology of Ethnocentrism. Evolutionary Dimensions of Xenophobia, Discrimination, Racism and Nationalism*. London: Croom Helm.
- Richter, R. (1990) "Sichtweise und Fragestellungen der Neuen Institutionenökonomik," *Zeitschrift für Wirtschafts- und Sozialwissenschaften*, 110, 571–591.
- Rindos, D. (1985) "Darwinian Selection, Symbolic Variation, and the Evolution of Culture." *Current Anthropology*, 26, 65–88.
- Rindos, D. (1986) "The Evolution of the Capacity for Culture: Sociobiology, Structuralism, and Cultural Selectionism." *Current Anthropology*, 27, 315–332.
- Rose, S., Lewontin, R. C., Kamin, L. J. (1984) *Not In Our Genes. Biology, Ideology and Human Nature*. London: Penguin.
- Rosenberg, N. & Birdzell, L. (1986) *How the West Grew Rich: The Economic Transformation of the Western World*. New York: Basic.
- Rudolph, W. & Tschohl, P. (1977) *Systematische Anthropologie*. München: Fink.
- Sanders, W. T. & Nichols, D. L. (1988) "Ecological Theory and Cultural Evolution in the Valley of Oaxaca." *Current Anthropology*, 29, 33–80.
- Schelling, T. C. (1979) *Micromotives and Macrobehavior*. New York: Norton.
- Schram, S. R., ed. (1987) *Foundations and Limits of State Power in China*. London: Chinese University Press.
- Seifritz, W., Mennig, J., & Kymäläinen, O. (1989) "Modelling the Acceptance Problem of Nuclear Energy by Nonlinear Dissipative Processes," in Cambel et al., pp. 287–315.
- Shue, V. (1988) *The Reach of the State. Sketches of the Chinese Body Politic*. Stanford, CA: Stanford University Press.
- Sieff, D. F. (1990) "Explaining Biased Sex Ratios in Human Populations." *Current Anthropology*, 31, 25–48.
- Siewing, R., ed. (1987) *Evolution*. Stuttgart: G. Fischer.
- Simon, J. (1990) "Population and Economic Growth," in Felderer, (in press).
- Smith, A. D. (1986) *The Ethnic Origins of Nations*. Oxford: Blackwell.
- Smith, E. A. (1983a) "Anthropological Applications of Optimal Foraging Theory: A Critical Review." *Current Anthropology*, 24, 625–651.
- Smith, E. A. (1983b) "Evolutionary Biology and the Analysis of Human Social Behavior," in Dyson-Hudson & Little, pp. 23–40.
- Sommer, J. W. (1989) "Unifying Themes in Non-Mainstream Economics: A Speculation," in Cambel et al., pp. 133–145.
- Stegmüller, Wolfgang (1986) *Die Entwicklung des neuen Strukturalismus seit 1973, Probleme und Resultate der Wissenschaftstheorie und analytischen Philosophie, Band II/3*. Berlin: Springer.
- Stephens, D. W. & Krebs, J. R. (1986) *Foraging Theory*. Princeton, NJ: Princeton University Press.
- Streit, M. & Wegner, G. (1988) "Information, Transaction Cost, and Catalaxy—Reflections on Some

- Key Concepts of Evolutionary Market Theory." *Beiträge zur angewandten Wirtschaftsforschung*, Discussion Paper 367–388, Mannheim.
- Tietzel, M. (1983) "Ökonomie und Soziobiologie oder: Wer kann was von wem lernen?" *Zeitschrift für Wirtschafts- und Sozialwissenschaften*, 103, 107–139.
- Tietzel, M. (1985) *Wirtschaftstheorie und Unwissen*. Tübingen: Mohr.
- Tietzel, M. (1988) "Zur Theorie der Präferenzen." *Jahrbuch für Neue Politische Ökonomie*, 7, 38–91.
- Tilly, C. (1975a) "Reflections on the History of European State-Making," in Tilly, 1975b, pp. 3–83.
- Tilly, C., ed. (1975b) *The Formation of National States in Western Europe*. Princeton, NJ: Princeton University Press.
- Todd, E. (1983) *Le Troisième Planète: Structures familiales et systèmes idéologiques*. Paris: Editions du Seuil.
- Tullock, G. (1987) "Biological Applications of Economics." *The New Palgrave*, 1, 246–247.
- Voland, E. (1988) "Differential Infant and Child Mortality in Evolutionary Perspective: Data From Late 17th to 19th Century Ostfriesland (Germany)," in Betzig et al., pp. 253–262.
- Vollmer, G. (1987) "On Supposed Circularities in an Empirically Oriented Epistemology," in Radnitzky & Bartley, 163–202.
- Weber, M. (1922/1985) *Wirtschaft und Gesellschaft, Studienausgabe*, 5. Aufl. Tübingen: Mohr.
- White, C. (1987) *Russia and America: The Roots of Economic Divergence*. London: Croom Helm.
- Winter, S. G. (1987) "Natural Selection and Evolution." *The New Palgrave*, 3, 614–617.
- Witt, U. (1985) "Economic Behavior and Biological Evolution: Some Remarks on the Sociobiology Debate." *Journal of Institutional and Theoretical Economics*, 141, 365–389.
- Witt, U. (1989) *Individualistic Foundations of Evolutionary Economics*. Cambridge UK: Cambridge University Press.
- Wright, G. (1990) "The Origins of American Industrial Success, 1879–1940." *American Economic Review*, September, 651–668.
- Wuketits, F. (1987) "Evolution als Systemprozess: Die Systemtheorie der Evolution," in Siewing, pp. 453–474.

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