Hayek's Theory of Cultural Evolution Revisited:
Rules, Morality, and the Sensory Order[*]

by

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Abstract:

One of the most controversial parts of F. A. Hayek's work is his theory of cultural evolution. By starting with current discussions on biological and cultural selection theories we bring individual, kin and group selection aspects together and to shed some light on Hayek's thoughts on the Theory of Mind. We find that these thoughts traced out from his work on the "Sensory Order", need to be combined with his thoughts on cultural evolution. Both works can be backed by kin selection arguments and extended by a theory of cultural learning in which individual selection plays an important role. In doing so, we offer a more integrated view on Hayek's theory of cultural selection with respect to moral rules and collective choice processes in societies.

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Introduction

When societal evolution is at stake, economists usually do not follow the general thoughts of biological evolution and often argue that most of group selection phenomena would be incompatible with thoughts of methodological individualism. Nevertheless, recent emerging theories in social sciences contrasting biological with cultural group selection seem to redefine the issue and lead to some new insight on cultural evolution with respect to Hayekian arguments.

In our view, most of the current misunderstandings of Hayek's theory of cultural evolution results from the fact that Hayek has never delivered a complete theory of learning. This, until today, has lead to a rather restricted impact of his thoughts on cultural evolution in the realm of economics and public choice. Hayek therefore seems to offer a rather underdeveloped body of theories on how societies build and change their system of rules.

Newer theories suggest – based on a series of similarities to Hayek's own thinking – that cultural transmission, consistent with his importance placed upon the selection of rules by individuals, leads to a model of group selection in the Hayekian sense.

By focusing on a kin selection model and on conservative learning we try to unify Hayek's central aspects stemming from his work "The Sensory Order" with his Theory of Cultural Evolution. In our view, a first new viewpoint stems from Sober and Wilson's (1997:165) statement that "[s]ocial norms can favor the evolution of group-level adaptations by altering the costs and benefits of altruistic primary traits and by creating a diversity of internally stable social systems that can be sifted by group selection".

As is well known, Hayek's main argument on group selection is that by choosing rules individuals change their group and become a member of the group from which they adopt the rules. This argument may be supported by models of cultural kin selection since in cultural processes the strategies (rules) are not transmitted by genes but by learning. Since rules have signaling qualities, individuals are able to distinguish societies by their rules and choose their group via the selection of rules.[2]

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[2] This, of course, involves a second and related critique. See Vanberg (1986:87).

Second, group selection is not the only process of biological and cultural evolution. Group selection, following Sober and Wilson (1998) is a multilevel process covering individual, kin and group selection. In much the same way, one cannot allow for individual selection and exclude kin selection or group selection arguments. All three aspects matter as "distinctions between individual, kin, and group selection arguments ... derive primarily from differences in emphasis rather than from differences in fundamental concepts."[3] Individual selection means that only a single strategy is selected which means that the relevant group consists of only one genotype. By extending the selection unit to a family, kin selection is operating, while the selection of a whole group corresponds to properties of a larger group. (Sober and Wilson 1998:67). We argue that any useful approach needs to focus both on individual and group selection phenomena. It is more appropriate to stress the consequences of individual choice for group or kin selection when the explanation of cultural evolution is at stake.

The mere point is that in Hayek's theory as well as in most models of kin selection, the conclusions drawn today still do not thoroughly explain the transition of small groups to open societies. In order to capture these properties it is necessary to model the selection of rules. Furthermore, Hayek's ideas on group selection follow current thoughts on cultural selection: A group that becomes extinct does not require physical death of the individuals. The extinction of a group in the cultural sense simply means that all group members became members of different groups by adopting all their - different - rules.

By starting with the setting of current approaches we are able to narrow down Hayek's intention: Following Boyd and Richerson (1985:283), the specific claim about cultural transmission is that it "differs from genetic transmission because it includes the inheritance of acquired variation".

Next, Hayek is not a biologist. Hayek's approach follows much closer an individualistic and subjectivist approach to cultural evolution than biologists. His intention is not to extend the Darwinian theory of social change to culture and to ask, to what extent cultural transmissions might match Darwinian principles in order to describe the same process of evolution, since "whether group selection also operate in biological evolution remains an open question – one on which my argument does not depend."[4]

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[3] Uyenoyama and Feldman (1980:396).

In our view, most of the unnecessary critique on Hayek is based upon an ill-suited perception of his thoughts on cognition. Vanberg's (1986) critique holds insofar as methodological individualism can hardly be the adequate method to form a *complete* theory of human evolution from instincts to reason. It is rather the failure of Hayek's theory to explain cultural evolution without an underlying theory of learning. Vanberg (1986) is right that Hayek's notions on group selection, seen from the current state of existing models seem particularly vague; in addition to that one could easily argue that Hayek never followed completely all the implications of individual, kin and group selection in his theory of cultural evolution. This incompleteness is simply due to the fact that he failed to strengthen his arguments of individual selection taking place.

Moreover, we think that Hayek's intention was clearly what Sober and Wilson (1998) stated, namely that cultural evolution leads to more or less adaptive subgroups, without assuming that any selection process needs to lead to optimal results. In our view, Hayek's achievement was especially to point out *how a gradual suppression of instincts together with the emergence of individual selection leads to modern societies*.

Morality

In a new paper, Rubin (2000:1) addresses the implication of group selection for the analysis of human altruism and finds that "[m]orality tends to mimic the effects of group selection" (Alexander 1987:192). More differently, Hayek did not directly follow Darwin's approach to explain morality in human evolution as a phenomenon of group selection. His argument is on the effects of individual selection and morality. In most human social groups, cultural transmission is guided by a set of norms that identify what counts as acceptable behavior. Cultural transmission itself has adaptive advantages in highly variable environments (Richerson and Boyd 2000:11). If we follow the Campbellian notion, "[h]uman culture is information transmitted from person to person via teaching and imitation, much as genes are information transmitted from person to person in the course of reproduction."[5] Within this manifold process, Hayek focuses on the individual choice of moral rules and the effects resulting therefrom.

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[4] Hayek (1988:25).
[5] Richerson and Boyd (2000:1). The idea that natural selection would be "the master force in cultural evolution" is of course not followed by Hayek.

Altruism

Hayek's goal of explanation is not the explanation of the emergence of altruism but the evolution of the Open Society. This, like any society, needs altruistic behavior. However, this does not mean altruism needs to be the *explanandum* of cultural evolution. Altruism does not form the core of Hayek's work; what he had in mind was the double-sided aspect of individual and group selection. Rubin's (2000) argument is that "tastes" for altruism lead in the right direction "because group selection sets the limits for altruism". Hayek, in this analysis, analyzes the long-term effects of rules on groups and their growth when individuals – in the extreme - select their group membership by selecting the rules.

Hayek's three steps toward cultural evolution

Hayek mentions three levels of human evolution and in consequence of the evolution of specific rules therein. [6]

- Biological evolution: The first level of evolution which is formed by biological evolution forms the man's early and primordial history. At this level we find genetically fixed specific social behaviors emerging through a selection process. As a consequence thereof human instincts are fixed. Without those instincts individuals are unable to survive in this early stage of human evolution. Due to their genetic fixation, instincts form part of human behavior despite their counteracting quality in evolved societies.

- Evolution of intelligence, knowledge and rationality: The second level of societal evolution concerns the evolution of human intelligence, knowledge and rationality. However, this does not form civilization. Hayek emphasizes that the development of cultural evolution occurs before the evolution of human reason.

- Evolution of civilization: The third level has to be located between the development of the instincts and the development of human reason. At this level civilization gains ground.

By focusing on these three different levels, Hayek explains the stratification of the rules of conduct. Hayek starts by mentioning that the rules of conduct have a broad foundation in

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[6] Witt (1994).

instincts, being developed on the first level of evolution, followed by a large number of rules of conduct that humans have learned to adopt during the different social orders they have passed through. Starting from the tribe, where individuals must follow only a small number of rules of conduct based on tradition as the other rules of conduct are transmitted genetically, this number increases during the civilization process until the modern society has been reached. These rules are not consciously adopted by the individuals, they have spread out because some practices enhanced the prosperity of certain groups. The latest developed rules form a thin layer of consciously designed rules and follow a specific goal.

Hayek introduces his thoughts on societal evolution by starting with a situation where the genetic fixation of instincts occurs. As a result, small groups can be built. In this "face-to-face society" strong linkages with relatives are prevalent. Instincts play a decisive role and represent the best available adaptations to the prevailing environment. These instincts Hayek calls the *moral rules of small groups* or the natural morality.[7] They serve to steer the cooperation of the members of the group. This form of cooperation has been established by trust; the behavior among the members is supported by altruism, solidarity, sympathy and group decisions.

The important step forward in societal development takes place with a change in the environment, together with the introduction of trade. At this point the group and its behavior will change and as a consequence a new social order will arise.

Hayek, quoting Trotter (1916) consequently extends his theory towards individual selection: "This gradual replacement of innate responses by learned rules increasingly distinguished men from other animals, although the propensity to instinctive mass action remains one of several beastly characteristics that man has retained."[8]

Hence, it is not the instincts that lead to a beneficial life within the group, but the gradual suppression of the instincts together with the correction of the old rules of conduct or the development of new rules of conduct. The possibility of trade with individuals who are not members leads to the division of labor and specialization and as a consequence of the division of knowledge. Trade cannot be based upon collective knowledge but it needs the existence of a distinctive, individual knowledge. As a consequence private property instead of common

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[7] See Hayek (1979:153-176) and Hayek (1988:12).

ownership needs to be established. According to Hayek[9], private property is the fundamental principle of the cultural evolution. These new phenomena let the group grow richer and faster, but the consequences of the new experiences are the separation of goals for different members. Hence, individually different knowledge leads also to a different perception and to an individually different cognitive framework.

At this point in the evolutionary process the rules of conduct embedded in traditions become abstract and refer to bans and prohibitions. Different groups of individuals use different spontaneously emerging rules of conduct. These rules are selected and those groups which by accident follow the best selected rule survive better than other groups. Examples of rules emerging in this way are the rules of morality, here: the moral rules of the large group. These rules – in Hayek's own words - concern private property, honesty and savings and are embedded in traditions and transmitted by learning. The new rules of conduct, embedded in traditions, need to be transmitted from one generation to the next. This is possible through the cultural learning mechanism, which starts at an individual level, but also occurs on a group level.

Cultural learning and hence the individual choice of rules enables an Open Society - open in the sense of openness for strangers. Cultural evolution is not only supported by tradition but also by reason. Moral rules of conduct that emerge spontaneously cannot be understood by reason. Here, tradition can be seen as the special endowment of individuals that operates on a different plane compared to reason. [10] Reason, in Hayek's eyes, can help to reconstruct parts of human traditions and thus parts of moral behavior, but will never be able to construct an entirely new moral system or dismiss all the traditions that have emerged through time.

In order to understand this individualistic perspective it is important to focus on Hayek's notion that the competition of rules leads to the social order. Both abstracts and concrete types of rules of conduct form a framework of rules in which a selection process takes action.[11] Any change in the environment necessitates a reaction by the individuals. Old rules of conduct will

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[8] Hayek (1988:16).
[9] See Hayek (1988, ch. 2 and 3)
[10] Hayek (1988:52): "Indeed, the basic point of my argument – that morals, including, especially, our institutions of property, freedom and justice, are not a creation of man's reason but a distinct second endowment conferred on him by cultural evolution – runs counter to the main intellectual outlook of the twentieth century."
[11] Hayek (1988:74) "Civilization is not only a product of evolution – it is a process; by establishing a framework of general rules and individual freedom it allows itself to continue to evolve."

be tested through the selection process about their beneficial outcome for the society, which means the growth of the group.

Two different types of selection now govern the behavior of individuals: Either regularities of action arise from innate and genetic behavior, or they are learned and stem from learning processes influenced by human civilization. Any change in the rules of conduct is of course the outcome of an evolutionary process, but due to the subjectivist character of the cognitive processes it is not a predictable one.

Hayek's morality of small groups: a simple kin selection model

We argue that Hayek's model does not follow a general model of group selection but resembles a series of properties within kin selection models where the strategies are not transmitted genetically but by learning. This idea is supported by Hayek's thoughts on the transmission of the rules of morality by learning. Modern learning theories, which emerged after Hayek's death deliver the current explanation of Hayek's intention and solve many of his problems he faced by redefining his own ideas against the realm of biological theories. Kin selection models in general provide explanations to a broad series of problems in social and cultural evolution. Their extension to cultural evolution may be helpful *because of* the "human capacity for reckoning kin beyond the associative contiguity of mother and sibling".[12]

In order to back Hayek's thoughts on small groups we may use a kin selection model. At this starting point instincts and thus genetic transmission determine individual behavior. Myerson et al. (1991) offer an explanation stemming from the strand of biological games. Contrary to economic games that matches Hayek's morality of small groups. Knudsen and Foss (1999) define a kin group as a group of individuals who have the same genotype and therefore use the same strategy and introduce a viscosity parameter δ with $0 < \delta < 1$.[13]

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[12] Campbell (1983:11)
[13] Knudsen and Foss (1999).

Two types of interactions occur:

- An individual meets an individual in the subpopulation with probability 1-δ .

- An individual meets his kin with probability δ. Meeting a kin implies meeting an individual playing the same strategy and having the same expected value of future payoffs- or simply: doing exactly the same. Kins do exactly the same – no matter what they really do – following a certain and well-defined and shared mental model. Their mental model may change over time as well as their goals, but it is necessary for the argument that kins always do the same.

Interactions with kins means at least to have the same definite goals, while an interaction with other members of the subgroup needs only to have the same concrete goals as a basis for cooperation.[14]

Formally, following Myerson et al. (1991), σ (d) denotes the fraction of the population playing the strategy d. Of course, $\sum_d s(d) = 1$. The standard case to play a strategy e in a population delivers the following expected utility by summing up all utilities, times the probability of their appearance within the population:

$$u(e,P) = \sum_d \big[s(d) \cdot u(e,d) \big]$$

where u(e,d) denotes the utility playing e against d. By using this form we get

$$u(e,P) = d\, u(e,e) + (1-d) \sum_d \big[s(d) \cdot u(e,d) \big]$$
$$= \sum_d s(d) \big[(1-d)\, u(e,d) + d\, u(e,e) \big].$$

Here, σ is a d-*viscous population equilibrium* (Myerson et al. (1991:103).

By using $u'(e,d) = (1-d)\, u(e,d) + d\, u(e,e)$ as a new game we can transform the following simple PD-game with the following payoff

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[14] See Hayek (1979:153-176).

	C	D
C	3 / 3	0 / 5
D	5 / 0	1 / 1

into a perturbated game with the following utilities:

$$u'(c,c) = (1-\textbf{\textit{d}})\,u(c,c) + \textbf{\textit{d}}\,u(c,c) = u(c,c) = 3$$
$$u'(c,d) = (1-\textbf{\textit{d}})\,u(c,d) + \textbf{\textit{d}}\,u(c,c) = 3\textbf{\textit{d}}$$
$$u'(d,c) = (1-\textbf{\textit{d}})\,u(d,c) + \textbf{\textit{d}}\,u(d,d) = 5 - 4\textbf{\textit{d}}$$
$$u'(d,d) = (1-\textbf{\textit{d}})\,u(d,d) + \textbf{\textit{d}}\,u(d,d) = u(d,d) = 1$$

This perturbated game leads to the following pay-off matrix:

	c	d
c	3 / 3	3δ / 5-4δ
d	5-4δ /3δ	1 / 1

It is easy to see that a no Prisoners' Dilemma properties arise as long as δ exceeds ½. This backs Hayek's some thoughts on primitive societies: morality needs to create an environment where people behave the same way. Defection is driven out by this assumption or: cooperative behavior in small groups is ensured not by rationality, but by the behavioral assumption that kins behave the same way. In part, this matches the earlier argument of Hayek's theory of mind: Cultural evolution coincides with traditions that generate a sufficiently high state of equal-minded behavior and thus a sufficiently high δ.

Basing on Hamilton (1964), Knudsen and Foss (1999) argue that under certain conditions of inter-group selection cultural evolution can only be possible when cognitive friction *between the groups* exists. Also, cooperation in societies does not depend on the *absolute value* of δ_i. It is only important that the average δ meets a certain value. Depending on the setting, this average δ can be relatively small. This leads to a first interpretation of altruism in cultural evolution: The transition from a small group to an open society may be accompanied by a less necessity to behave as kins: Individuals interacting with others in different subgroups do not

need to meet their kins in all subgroups any longer with a probability of at least 50% in order to rule out defection.

Extending the thoughts: Cultural learning and Hayek's Sensory Order

Despite this interesting starting point, simple kin selection models show a not unimportant drawback: kinship arguments are not suitable for explainig cooperation in human society at large. First, as Eshel et al. (1999) argue, two randomly chosen individuals are not likely to be related. Second, genetic transmission does not lead to uniformity in human kin groups. Third, a change of rules is limited to what Hayek calls a change of the sensory order. As implied in the model above, if selection occurs, all kins must change together since they share a strategy they need to ensure cooperation in their small group. Kinship behavior ensures cooperation, but to change behavior, all kins must change. Also Knudsen and Foss (1999) do not follow an individual learning theory. In detail, they do not explain *how* structured interactions are intertwined with individual learning processes and the selection of rules in a dynamic setting since their theory focuses on firms. In other words, cognitive friction in general is a Hayekian argument, however it does not deliver further insights on why individuals may decide the one or the other way. Wherever the learning behavior of individuals does not change, this leads to the relevant kin selection environment. While the Hamilton (1964) and Myerson et al. model (1991) are able to explain kin selection and thus the morality of small groups, we also want to show how by an *individual* choice of rules from a broader environment the large society may evolve. Cultural learning has a different starting point compared with kinship behavior.

In Hayek's definition, rules of conduct are instructions on how to act. Many of them are transmitted genetically, however, most of them evolve during societal evolution In this case they represent cultural heritage. Rules that are not fixed genetically need to be acquired by the individual, in short, they must be learned. Every individual has his specific sensory order and therefore he perceives in a specific way because of his specific social environment where he interacts with members of his kin group which in any case has lead to his specific history of perceptions. Simultaneously he shares a series of other perceptions stemming from his interactions with the whole subgroup he is living in. This point refers to the intertwined character of rules and the social order. Rules hence may be distinguished by their type of transmission (genetically or by learning) and by its degree of complexity.

Commands as an example of rules of lower complexity form a well-defined instruction of conduct. We can find this kind of rule in well structured orders like in small groups, such as organizations, families or primitive groups. Commands concern only specific individuals in their specific situations. If the environment becomes more complex, the rules of conduct gain complexity. These rules are abstract ones, they usually arise spontaneously and play an important role in Hayek's theory of cultural evolution since they push forward the evolution. These abstract and spontaneously emerged rules, like language, the rules concerning property and the rules embedded in traditions and morals do not necessarily need to be understood by individuals. Usually individuals do not even know that they act in conformity with such rules. In these kind of rules we may find implicit knowledge: the rule doesn't have to be verbalized and consciously known by all members.

An important element separating Hayek's work from standard scholarly work is the dispersion of knowledge. The key is that routines, used by members in a group, have been internalized in the human mind so that individuals may use it without reflecting on it. This leads to a first implication for the emergence of rules of conduct. The capacity to behave in a specific way according to special rules is intertwined with Hayek's concept of tradition. Implicit knowledge is embedded in traditions and therefore not accessible to rational explanations. In other words, related rules of conduct contain a high degree of tacit knowledge and thus cannot be reconstructed or consciously designed.

Hayek's thoughts on the Theory of Mind begin with his rejection of tangible events. Human perception can only be reduced to some aspects of an event. Hayek explains the sensory order as a system of classification of categories and hence a tool anybody uses for classifying and ordering his perceptions.

> "All that we can perceive is thus determined by the order of sensory qualities which provides the „categories" in terms of which sense experience can alone take place."[15]

The sensory order is based on pre-sensory experiences. These in turn are the product of the effects occuring through physiological impulses.[16] The set of impulses forms the sensory order.

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[15] Hayek (1952:167).
[16] See Hayek (1952:8-12).

"The process of experience thus does not begin with sensations or perceptions, but necessarily precedes them: it operates on physiological events and arranges them into a structure or order which becomes the basis of their "mental" significance; and the distinction between the sensory qualities, in terms of which alone the conscious mind can learn about anything in the external world, is the result of such pre-sensory experience. *We may express this also by stating that experience is not a function of mind and consciousness, but that mind and consciousness are rather products of experience.*"[17]

In a first step pre-sensory experiences form the sensory order. In a second step, physical events, perceived through the sensory order lead to an abstract and categorized perception.

The sensory order thus forms a cognitive framework for individual choice. Physical events in the environment which meet the human organism start its function. These physical events are classified through the sensory order. The perception of individuals will be filtered by an act of classification. Hence, the sensory order is unable to capture all the relevant aspects of an incoming event since it is formed through pre-sensory experiences. At the beginning of human evolution, only certain aspects that are crucial for the survival of the individual can be captured and classified and thus transmitted towards the creation of an abstract perception.[18] This "pattern recognition" enables what Hayek calls the ability of recognizing only certain aspects of physical events. An individual cannot understand complex phenomena like markets or other systems of social order with respect to all their aspects. Hayek's point is that since they are simply not known at all, individuals may only predict the *pattern* of an event, but not the event itself.

This notion makes clear that in Hayek's view perception follows the sensory order. The latter, as a system of classification is only capable to order perceptions that follow a certain regularity:

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[17] Hayek (1952:66,§8.5)

[18] Bouillon (1991:83) explains Hayeks's sensory order using the following example: We take the sound of a clattering door as a physical event. The noise may be either the product of a synthesizer or of a real clattering door. No matter if the sound is produced by a synthesizer or by a real door, the sensory order classifies the rumor of the synthesizer as belonging to the same class of sounds. Classifying means the process through which

> "Another interesting consequence following from our theory is that a stimulus whose occurence in conjunction with other stimuli showed no regularities whatever could never be perceived by our senses (6.36) This would seem to mean that we can know only such kinds of events as show a *certain degree of regularity in their occurence in relation with others, and that we could not know anything about events which occured in a completely irregular manner.*" [19]

Classes of stimuli lead to classes of responses: the *set of rules* from which individuals select their own rules stems from individual perception and hence from their history. As Rizzello (1997:241) emphasizes, it is mainly the *feedback* in any agent-environment relationship that gradually leads to the formation of classes of stimuli and classes of responses.

Individuals therefore form their own sensory order that consists of the mental schemes acquired by their own perception and history. To which extent people choose their rules they accept will be influenced by the set of rules they already have learned.

In our view, two results are important for the rule selection process:

First, individuals perceive only rules from outside that can be classified by their mental schemes and hence their already perceived set of rules formed by their own history. At the beginning, individual perception is only allowed to vary slightly, otherwise the individual would be unable to recognize the rules as such:

> "The point on which the theory of the determination of mental qualities ... differs from the position taken by practically all current psychological theories is thus the contention that the sensory (or other mental) qualities are not in some manner originally attached to, or an original attribute of, the individual physiological impulses, but that the whole of these qualities is determined by the system of connexions by which the impulses can be transmitted from neuron to neuron ... that this system of connections *is*

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different events (synthesizer or door) are put into the same category. Our senses will hear only the abstract aspect: clattering.
[19] Hayek (1952:176,§8.39).

> *acquired in the course of the development of the species and the individual*
>
> *by a kind of 'experience' or 'learning' .. ."*[20]

Therefore, the group exerts an important influence on the phylogenetic development of the individual by contributing to the formation of the individual sensory order. As pointed out below, this meets the requirements of a conservative learning model as described in Eshel et al. (1999).

Second, following Hayek, a change in the set of rules that may be selected can only occur via a change of individual perception. This needs to change the environment. Eshel et al. (1999), following D. S. Wilson, presents a model with different learning and interaction environments and show many similarities to a Hayekian model of cultural evolution.

Cultural evolution: kin selection and learning

Eshel et al. (1999:450) characterize cultural evolution as different from the genetic one as occur when "an individual adopts a new mode of conduct he learns a set of rules that determine his random behavior"[21]. Starting with the concept of Evolutionary Stable Strategies (ESS) they define an unbeatable strategy as one to which a dynamic process converges - starting from a state in which all but a finite number of individuals plays this strategy. In this way, the local interaction structure matters as the individual strategy interacts with the strategies of the individual's immediate 2k players.

Playing a symmetric finite game W, the player gets the payoff as the sum of the payoffs from his interaction with all his neighbors. The important feature of the Eshel et al. (1999) model that makes it particularly suitable for an interpretation of Hayek's process of cultural evolution is the possibility to distinguish between learning and interacting neighborhood: As long as n equals k, we have the situation of the "morality of the small group". In this case, intra-group selection cannot lead to a large culture since the rules.[22]

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[20] Hayek (1952:53), our italics. As Bouillon (1991:78) explains this relationship, ontogenetic development attributes an individual sensory order to any human, while the phylogenetic development shows a series of parallels of the relative sensory orders in a group and hence forms the collective quality of the sensory order.
[21] Eshel (1999:450).
[22] See e.g. Sober and Wilson (1998).

To allow for cultural evolution, we need a process where the learning neighborhood n is larger than the interacting neighborhood k – in Hayek's view due to the extended mental abilities that lead to a learning "governed by tradition and reason" and reflects the his thoughts on experience and learning of the sensory order sketched above.

In the extreme case, where n = 1, an individual imitates only one of his immediate neighbors (Eshel et al., 1999:455). In this case, any k leads to conservative learning processes and strategies yielding the pareto payoff in simple coordination games are also unbeatable strategies. If, more realistic, neighborhoods are large and the learning neighborhood is much larger than the interacting neighborhood, the conditions for unbeatability differ. For sufficiently large n, k with n/k = θ in the Eshel et al. model the two conditions for unbeatability can be combined by defining r (θ) as:

$$r\ (\theta) = \begin{cases} \dfrac{\boldsymbol{q}}{2} & if\ \boldsymbol{q} < 1 \\[2mm] 1 - \dfrac{1}{2\boldsymbol{q}} & if\ \boldsymbol{q} \geq 1 \end{cases}$$

Following Eshel et al (1999:456) r takes values between 0 and 1 and is small when the interaction neighborhood k is bigger than the learning neighborhood n, whereas r gets close to 1 when n is larger than k. Eshel et al. (1999:460) show that the unbeatable strategy in a Prisoners' Dilemma game is the cooperative one: For a sufficient large r, strategy C is unbeatable in {Ω, r} if and only if it is unbeatable in {Ωʳ, 0}, where Ωʳ denotes in a standard Hawk-Dove situation:

a (1+r)	b + rc
c + rb	d (1+r)

Since a strategy C is unbeatable in {Ωʳ, 0} if for every strategy $\underline{y} = (y_1, y_2)$ with $y_2 = 0$ one can transform the following equation - since $\boldsymbol{w}^r (\underline{y}, \underline{y})$ denotes the payoff of the strategy $\underline{y}$ agaeints itself in Ωʳ

$$a(1+r) + a(1+r)y_1 + (b+rc)y_2 > \boldsymbol{w}^r (\underline{y}, \underline{y}) + a(1+r)y_1 + (c+rb)y_2$$

into

$$(1+r)[(2a-b-c)y_1 + (a-d)y_2 > (1-r)(c+b).[23]$$

Since in the Prisoners' Dilemma a-d is always positive and one can assume that 2a-b-c > 0, the above inequation holds for any r sufficently close to 1. The outcome of the Eshel et al. (1999) model hence is that to cooperate is an unbeatable startegy whenever r is sufficiently high.[24] Compared to the outcome of the extended Myerson et al. (1991) model this shows that cooperation the properties are much more Hayekian: The result does not occur due to the interaction with kins, but stems from a learning assumption where individuals learn only when at least one of his two immediate neighbors plays a different strategy to his. This reluctance to learn fits cultural learning much more that a biological setting and describes human behavior in a cultural evolution setting.

As Eshel et al. (1999:462) conclude, the conservative assumption may also be relaxed: If an individual is permitted to learn with a small probability when his two immediate neighbors still use the same strategy and one of his four immediate neighbors plays a different one, the results do not change.

Extensions

Again we should focus on the implications of both individual and group selection. Hayek's definition of morality has been equalized in the biological sense that morality may lead to unselfish behavior among seemingly self-interested individuals. Morality instead forms the current system of rules that *defines individual action*. It can be chosen by individuals following certain patterns of perception and learning: Moral rules are the strategies that form individual action and that identify the members of a group. Following a learning process, moral rules can be learned by members of a different group. If an individual has adopted a sufficient degree of moral rules of another group, he becomes member of this group.

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[23] Eshel et al. (1999:460).
[24] See Eshel et al. (1999:462). In contrast, Eshel (1972) has shown in an earlier deme model that mobility may be detrimental for altruism. See also Uyenoyama and Feldman (1980) for further discussions.

As mentioned already above, Vanberg (1986) argues that Hayek's theory of cultural evolution suffers from his attempt to combine an individualistic approach with a behavioral one. Later, Hodgson (1993) has extended parts of this critique[25]. We find that only Vanberg is right when criticizing Hayek's theory with respect to the question of collective action. His critique is rather fundamental in the sense that he focuses on the central quality of Hayek's selection process which he finds unapplicable to problems of collective choice. In his view, other than the rules of morality, constitutional rules - once established - cannot be altered by a spontaneous process which may enable groups to adopt more efficient constitutional rules since any change of these rules needs a collective choice mechanism.

To solve this problem from a current standpoint, one has two choices. The first one is, as Sabooglu and Langlois (1995) did, to argue Hayek simply was not interested in defining and analyzing clearly the rules that create an order and thus offered a rather incomplete model from a public choice standpoint.

The second one is to follow Hayek's notion that not only spontaneous processes emerge in societies. In many cases a deliberate change of existing rules may form the only useful solution (Hayek, 1973). Our interpretation is that by choosing new rules of morality individuals exert power on societies to change constitutional rules. The relevant question of group selection is now if societies change their system of concrete rules or rather get selected out in the process of rule selection.

Hayek clearly argued in many of his works that spontaneous processes may also lead to pressures in societies not only to punish deviators but also to change existing constitutional rules. These processes of change however may be slower than the adoption of different moral rules by individuals.

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[25] On the viability of Hodgson's argument see Zywicki (2000:88) who boils down Vanberg's critique to his scepticism about the viability of group selection to punish free riders and shows evidence for the human ability to detect and punish cheaters, our focus is on the implication of individual selection to collective action.

Conclusion

Rules per se have the general quality also to signal individuals in *other* groups to become member of the group by adopting the rules. Again, cultural evolution is an open-ended process. Following Sober and Wilson (1998), it is not sure to which end our societies will come. It might also occur that human evolution will tend toward an adaptation of other concepts. In our view, it is the individual perception governing the process of cultural evolution. Individual perception also includes stability against the threats of mobility. (Eshel 1972).

The outcome of the selection process cannot be taken for granted in the sense that a group will grow richer than other groups that do not act according to these specific rules. It is also possible that non-efficient rules may gain ground and suppress the more efficient ones. This is also valid for the rules of morality. Hayek deliberately mentions that societies may practice a "wrong" morality and may therefore decline.

With respect to large groups, Hayek shows many similarities to the later ideas of Denzau and North (1994) in predetermining individual behavior through ideologies. His argument however differs since he stresses the individual side: Whether individuals decide against or in favor of one specific rule, this behavior cannot be captured by a group-specific prerequisite, it will remain always their individual decision. Hence, Hayek's approach on human cognition is not based on group-guided ideologies.

Instead, he highlights individual selection at the very end: At this stage, the deliberate setting of social and constitutional rules – extisting in virtually all societies – have overcome the Hobbesian state of nature - and the question, to which degree individuals follow this rules depends on individual perception. We have argued that cultural learning and hence individual rule selection forms the restriction in human cognition due to the moderating effect of tradition on individual cognition. The Hayekian preposition to preselect moral rules ensures that humans seldom recognize rules that are *completely* different from existing ones – in other words this reflects the prerequisite for a conservative learning environment leading from a kin selection model representing the "small group" where behavior stems from instincts – up to the open society where the learning neighborhood is larger than the interacting group of an individual.

Hayek's thoughts might again gain ground since game theorists increasingly focus on cognitive elements together with the analysis of how norms are applied and maintained. Norms do not stand alone in a social process. If "the maintenance of norms has a cognitive component, it is also the social process."[26] This point of view reveals some of Hayek's way of defining the problem: The environment of interactions itself determines the extent to which norms will be accepted in a society. As Bicchieri (1997:38) states, it plays a crucial role for the survival of a norm in a group *how* individuals accept a norm. Here again, norms may create behavioral uniformity, but Hayek's emphasis was on individual selection.

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[26] Bicchieri (1997:38).

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