View metadata, citation and similar papers at core.ac.uk
brought to you by CORE
provided by OTHES

MAGISTERARBEIT

Titel der Magisterarbeit

Economics of Sociality

Verfasser

Johannes Jäschke Bakk.rer.soc.oec.

angestrebter akademischer Grad

Magister der Sozial- und Wirtschaftswissenschaften
(Mag.rer.soc.oec.)

Wien, August 2011

Studienkennzahl lt. Studienblatt:	A 066913
Studienrichtung lt. Studienblatt:	Volkswirtschaftslehre
Betreuerin / Betreuer:	A.o. Prof. Wolfgang Weigel

Table of Contents

1. Introduction

Humans are unique among all social animals with respect to their ability to cooperate in sizeable groups. As distinct from other primates we are able to establish evolutionary stable cooperation in groups where the number of unrelated individuals surpasses the number of related ones. Humans today cooperate in anonymous global markets with partners they have never seen before and will probably never see again. And although markets repeatedly fail one can assume that this is not the general rule.

So why do we behave the way we do? The scientific community commonly agrees on the framework leading to the adaption of large scale cooperation in groups of conspecifics. But there is still no common agreement on which mechanisms eventually lead to this behavior. Most prominently two trends can be recognized in the research of the mechanics of economic behavior, namely *bounded rationality* and *social preferences*.

Research on bounded rational agents is a comparably older approach. Emerging with Simon`s (1955) work on a „behavioral model of rational choice“ it is aimed at introducing more realistic theories of economic agents` decision making processes into orthodox economic theory. Taking up the findings of psychology of how decision processes in real world interactions are executed in humans, behavioral economists concluded that agents frequently use non-optimizing procedures when having to choose between different options instead of calculating probabilities and maximizing utilities in the classic sense. Since these procedures are mainly constrained by a lack of information, the time accuracy of the decision process or limited search possibilities (Gigerenzer & Selten, 2001) these agents must be regarded as being by far not as rational as suggested in orthodox economic theory. As Kahnemann and colleagues showed, this can mean for example that choosing agents usually do not use Bayes` rule, a finding that strongly questions the assumption about the monotonicity of preferences (Kahnemann *et al.*, 1982). So much more than rational decision making resulting in orthodox optimization behavior it is assumed that humans use simpler step-by-step rules, so called heuristics. These heuristics are adapted to particular environments and thus result in fast frugal and accurate choices (Selten, 2001).

Although the bounded rationality approach has revealed many shortages of the traditional assumptions concerning decision making processes of economic agents, up to today it has failed to establish a theoretic framework for a more accurate economic theory of human choice and grounding preferences. The roots of this problem may be twofold. First of all bounded rationality as a discipline researching the „proximate mechanisms (the heuristics) that animals, humans, institutions, and artificial agents use to achieve their goals“ (Gigerenzer & Selten, 2002, p.10) may just be too broadly defined. It is hardly imaginable that a discipline that restricts its view on observations of the limitations of individual optimization capacities is able to pave the ground for a universal theory of individual and collective action. Second and this may even support the previous point bounded rationality lacks having a sufficient explanatory basis for the detected heuristics.

Psychology itself as the oldest companion of economics in the field of bounded rationality failed to associate causes and consequences of the observed behaviors and resulting correlations a long time. Only with the rise of evolutionary psychology in the eighties the basis for a broader and founded understanding of human behavior was established.

It was this shift to acknowledging the validity of evolutionary biology and anthropology that must also be held responsible for the emergence of first interdisciplinary research projects connecting economics and biology more to each other.

The *social preference* approach as introduced in the following work can be seen as an epiphenomenon of economists` and biologists` joint search for the „nature and origin of preferences“ (Henrich *et al.*, 2003: 1) of the late nineties. In search of the answer to the question what shaped human preferences, and why instead of how human decision processes lead to observed outcomes some researchers more and more focussed on the core of economic decisioning, namely the ability and motivation to cooperate with reference agents. Most generally the principal-agent problem is a problem of failing or successful cooperation. In this line of thought research in the area of *social preferences* does not claim to result in a universal theory about the decision process itself but in understanding the nature and the extend of human self respectively other regarding behavior. As a complementary but by no means substitutional research field this branch may overcome the two proposed difficulties, bounded rationality has to suffer from. Its focus on just a part of the map of human decision possibilities helps to clarify at least some of the ambiguities bounded rationality stressed out in human behavior. And taking up pervasive findings and hypotheses of evolutionary biology and anthropology it can additionally help to build up a proper framework for the evaluation of motivations and goals of human decisions.

But however today economic research about the roots of sociality seems to be stuck out of quite different reasons and the interdisciplinary orientation towards evolutionary biology turns out to be a mixed blessing (West *et al.*, 2011).

Up to today research rather resulted in characterizations of the extent of diversity among economic agents and corresponding choices than in explanations of the very same. And furthermore, some of the main interpretations of social preferences leaning on theories of evolutionary anthropology, like the so called „egalitarian preferences“ (Gintis 2009: 70), in fact are pervasive but not necessarily correct. Newer research questions like those provided by Schmidt (2010) or Camerer and Fehr (2006) reveal that *social preference* theory significantly diverged from the initial premises about human sociality and thus runs the risk of failing to capture the essence of what it could be, namely a cohesive theory of human cooperation.

This master thesis aims at providing a more complete understanding of what are the underlying mechanisms of cooperation and competition and the behavioral transition from one to another. Since behavioral economic research about the social preferences of economic agents chooses the framework of evolutionary biology the second chapter will picture the roots of sociality from an ecologic as well as an evolutionary perspective. This will allow mirroring the multiplicity of influence factors that shaped and still frame social organization and social structure in human societies. As will be shown in this section it is furthermore of major importance to highlight the evolution of hierarchies in primates and the resulting adaptations in social and especially political behavior. The following chapter will deepen the understanding of the mentioned evolved behaviors by reviewing the main findings of behavioral and experimental economic studies of the last twenty years. Afterwards it will be critically evaluated whether these findings are reasonable or not. As a synthesis of the previous two sections in chapter 4 some structural errors and possible misconceptions of *social preference* theory are stressed out. Following this, a short excursus into the reasons for the socioeconomic status (SES) research being stuck in finding an answer to the question why ranks do impinge on health is provided. This is done with regard to Occupational Ethology (Wallner *et al.*, 2008) as a presented research project aiming at an investigation of the roots of sociality and consequences of lacking adaptive abilities towards modern workplace structures of agents. Due to its interdisciplinary background, OE is somewhat a convergence point for the different branches dealing with the mechanisms of failing cooperation and may thus overcome the limits *social preference* theory faces.

2. Sociality in Primates

“Sociality means group living”
(Alexander, 1974: 326)

The task of evolutionary biology and especially behavioral ecology is in particular to explore the selective forces shaping sociality. As will be seen in the upcoming subchapters, sociality or group living is dependent on various variables in all social primate species. Nonetheless the upcoming descriptions can only open the door ajar to a profound understanding of the interdependencies between natural and sexual selection and ecologic pressures. Hamilton (1964) showed that group living even on the nuclear level of the family is nothing but cooperation aimed at increasing fitness. Sociality can thus be regarded as the ability to organize and cooperate in groups of conspecifics. But still especially within the non-human primates and apes there is a lot overt competition driving out cooperation in many ways. The roots of this competitive behavior differ at most between males and females of all species reflecting different needs according to fitness maximization. It is suggested that humans at least in some respect have gained the ability to decrease the likelihood of the occurrence of a plenty of those competitive situations. Describing the uniqueness of humans` adaptive abilities which finds its peak in large scale cooperation in contemporary societies will thus end the evolutionary examination of the roots of human sociality from an evolutionary perspective.

Behavioral economists usually take the presented hypothesis about primate and thus human sociality as given. In this regard it is necessary to understand how external influences have shaped social hierarchies and to what style of living humans are adapted to if one wants to critically assess the state of the art in this branch as done in chapter 4. Since economic trade and resulting principal agent problems must be regarded as a specific form of successful or failing cooperation aimed at maximizing fitness, knowing about individual motivations and influencing factors to interact in frameworks where resources are acquired and reallocated might help sharpening the proposed traits of economic agents.

2.1 An Evolutionary Approach towards Sociality

The first profound exploration of Primate Societies started as a result of expansive field works in the 50's and 60's. Anthropologists' focus since then was mainly motivated by the possibility to reveal the foundations of human sociality (Kinzey, 1987). The exploration of primates' behavior in their natural habitats was and still is therefore a very important instrument. In contrast to captured populations the fieldwork yields insights of mammals' lives in a surrounding where social and ecological pressures interact (Strier, 2007). In reference to the human political spectrum one can therefore either account for different cooperative and coordinative habits in the numerous social mammal species or choose to restrict the view to the closest human relatives, primates.

The restricted choice of species of the hominoid spectrum as well as macaques and baboons as representatives of the cercopithecines in my work will allow mirroring the diversity of sociality and its variance at least to some extend. With respect to their highly developed complex social structures and the broad spectrum of cooperative strategies non-human primates and apes may also allow further insights into the hominid patterns of behavior. Additionally as recent studies showed the gene structure of macaques is still quite analogous to the hominid one matching with 93.5% (Gibbs et al., 2007). So although our last common relative lived around 25 million years ago analogies of at least some innate behavioral strategies can be supposed.

As can be seen in the referred works many authors use some terms especially the ones defining social systems like social organization, mating style or social structure not congruently along or consequently among different publications. Thus the afterwards used terms are defined with reference to Kappeler and Van Schaik (2001).

2.2. Sociality in Non-Human Primates

The evolutionary nature of the issue requires to begin by referring to the social systems of humans closest relatives, namely non-human primates.

Primates are mainly distributed to the tropical regions of Africa, Asia and South America. But the spatial variance of the environments is extreme according to the different climatic distinctions in these regions. Thus habitats include not just tropical forests but also open woodlands, savannas, mountainous highlands or mangrove forests and swamps (Strier, 2007, Boyd and Silk, 2009). The structural differences of biogeography strongly induce the dimensions primates' habitats. Prosimians with haunts being limited to tropical rainforests to a large extent can be characterized as arboreal species. With the increasing diversity of inhabited areas in which most Old World monkeys are located in by contrast the lifestyle switches over to semiterrestrial or terrestrial living (Strier, 2007) decreasing the complexity of the environment in its spatial dimensions significantly. The consequences of the different lifestyles manifest at a first instance in distinct activity patterns. While most Prosimians are supposed to be nocturnal the selected anthropoid species are just like all other of this spectrum diurnal. Being active at day and not at night is one major magnitude of influence to further differences in lifestyles of primates. Individual adaptations to this lifestyle range from larger body sizes and increased visual orientation to higher demands concerning the complexity of social specialization. The decreased complexity of the habitats' dimensionality is therefore replaced by higher demands in social organization.

2.2.1 Sociality as Response to Ecologic Pressures

> "Much of the day-to-day life of primates is driven by two concerns: getting enough to eat and avoiding being eaten" (Boyd and Silk, 2009: 127).

The reasons for sociality in Primate species are complex. Today the explanatory basis mainly refers to individual advantages in avoiding predators (Van Schaik and Van Noordwijk, 1985), foraging benefits for individuals in larger social groups (Eisenberg et al., 1972), and enhanced absolute reproductive success (Silk et al., 2003). According to the foraging benefits associated to increasing group sizes on the organizational level the main arguments deal with a proposed higher discovery rate of food resources, a reduced variation in individual intake rate and the ability to prevail over smaller-group incumbents competing for scarce resources (Janson, 1992).

While those benefits are usually not part of a critical assessment anymore, the eventual costs of larger group foraging indeed are. First, food is a scarce resource being exclusive in its consumption and primates usually do not share. But not surprisingly the availability of enough food considerably impinges on the metabolic processes, growth rate, and reproductive effort (Boyd and Silk, 2009). Second as Clutton-Brock (1974) hypothesized, group size is correlated to the availability of productive patches, allowing larger groups emerging in habitats with quantitatively and qualitatively higher resource allocation (see also Mori, 1979). But as White and Wrangham (1988) point out, this correlation is not to be generalized. Adding one individual to groups with maximal size yields to a significant decline in the average intake of energy. Increasing group sizes in consequence always lead to significant increases in individual costs. The inevitably following elevated intra-group competition for food can lead to a decrease in female reproduction rates and increases in mortality rates in the society (Dittus, 1979, Whitten, 1983). So the question if outcomes being balanced out by structural processes like intra- versus intergroup competition (Wrangham, 1980) result in net costs or net benefits still remains open.

Third as Janson (1992) points out, the opportunity costs of increased foraging efforts are not well defined and rarely predictable. As will referred to later especially cooperation in food acquisition and sharing reward social interactions in form of prosocial behaviors. These behaviors are not just essential for the emergence of high-level cooperation but also to a substantial degree part of daily routine in most primate species. Costly outweighing effects thus can be assumed herein.

Another root for primate sociality can be found in the prospect of minimizing the risk of predation, an opinion held most prominently by Alexander (1974) and van Schaik and Noordwijk (1985). Although there are not much data to support the main assumptions with hard facts there seems to be a consensus about especially two beneficial results of sociality, the vigilance and the dilution effect (Janson, 1992). While the former benefit is just as it is with the detection of new resources guided at the degree of informational openness of groups with respect to size in detecting predators. The latter one is an expression for a decrease in the probability of being subject to a predatory attack when group population is becoming more densely. Evidence for both effects and their proposed influence in favoring sociality can be found in Van Schaik (1983) and others. Since one cannot control for external factors and rarely exclude them in fieldwork, results in this regard may be significantly biased. Besides the problem of correlations to aspects of food acquisition as factors for different spatial characteristics field studies yet do not provide enough data to answer the question why the proposed benefits of growing group size outweigh the costs inherent to an increasing probability of being detected by predators.

2.2.2 Social Organization and Mating Systems

While the proposed mechanisms do offer probable explanations for the emergence of simple sociality and its' anchoring in primate populations they do neither offer reasonable guidance towards the observable versatility in the organization of the social spectrum nor give hints about inherent physical boundaries framing the extent to which sociality is possible.

Usual approaches that try to explain this variability deal with the occurrence of spillover effects or "complex feedback loops" (Kappeler and Van Schaik, 2002: 708) between social organization, social structures and social mating systems that in fact turn out to be quite eclectic. Influences that are referred to by authors in this context like spatial relationships between group members, territoriality of the populations or within-group aggressive behavior (Janson, 1992) indeed are important, but they are as well highly correlated to the above mentioned arguments for the occurrence of other pro-social behaviors itself. Disentangling the different mechanics would thus exceed the scope of this work by far.

With regard to the composition and the spatiotemporal cohesion, the variability of primate societies on the organizational level can be mirrored by the multiple possible lifestyles of the social mating system spectrum. A vital categorical distinction in here is whether it induces females and males to live solitary, pair-bonding or in groups (Kappeler and van Schaik, 2002). The resulting social mating systems for solitary females can be classified as monogamous-, polygynous- or polyandrous group-living (see figure 1).

In each of these systems females maintain personal home ranges while males either pair-bond, monopolize territories of multiple female habitats solitary, or cooperatively share separated groups of perceptive females and their offspring. Females sharing habitats with other mature females form either social one-male polygynous or multi-male polygynous groups.

In general, excluding many interspecific variations of the different species, cercopithecines typically live in multifemale-multimale groups in which dispersal is biased towards males (Melnick and Pearl, 1987). The hominoid spectrum towards sociality differs significantly in many ways. Varying mating styles throughout the various species holds the key to many observable differences in groups' social structures. The social mating styles in here range from solitary living, polyandry to polygynous fission-fusion groups including dispersal and second stage emigration of both genders (Boyd and Silk, 2009).

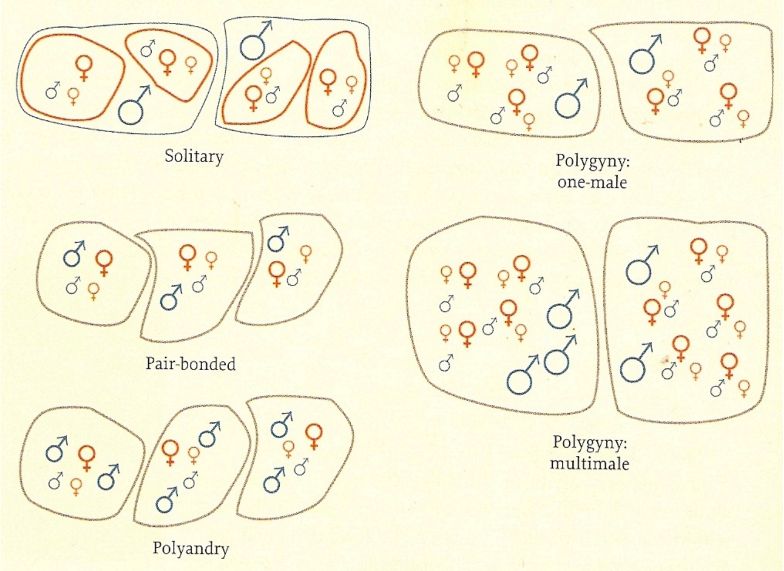

Figure 1: Classification of societal arrangements regarding male and female residency of mating styles. The sex symbols`s size gives hints about the degree of sexual dimorphism (Boyd and Silk, 2009: 142)

What one can say with regard to many explanations for the occurrence of social relationships among group members is that they are in most cases directed at explaining male-female or male-male relationships but not grouping strategies and their roots in female individuals (Wrangham, 1987). It is straight forward that sociality must be an optimal response towards ecologic pressures, guaranteeing high reproduction ratios in this framework. But the question how on the other side mating systems do influence sociality again is in most cases not answered satisfactory. And the styles of the different species are in some regard the signposts for further studies leading to the organizational level of sociality in primates. By focusing on the social organization of primate groups, besides predation and food acquisition (Boyd and Silk, 2009) the mating style, especially the way in which offspring is raised and mating partners are selected is the influential variable. Its occurrence can be seen as a "compromise between female and male strategies to gain access to mates, food and other resources that they and their offspring need to survive […] and vary with ecological and demographic conditions" (Strier, 2007: 141).

In its broadest sense different mating systems lead to the question which sexes turn out to be philopatric, a factor having a big impact on social organization. Many Old World primate species and nearly all social Prosimians show patterns of female philopatry, and dispersal as well as secondary emigration is significantly biased towards mature males minimizing the risk of incest and modifying size indirectly by changing the operational sex ratio (Pusey and Packer, 1987, Strier, 2007, Kappeler and van Schaik, 2002, Mitani et al., 1996). And although especially throughout the hominoid spectrum female individuals show a higher variability in dispersal patterns nepotism needs not inevitably to be precluded. The probability that dispersing mature females live together with kin again and show significant levels of nepotism is quite high (Watts, 1996) even if this is not because of coalitionary dispersal of kin (Stewart and Harcourt, 1987).

Wrangham hypothesized that this is due to increases in the direct fitness of individuals. In his view, females' fitness is in the first instance not limited by the number of potential mating partners but by the availability of resources providing enough energy for raising offspring (Wrangham, 1980). Since the ovulatory status is highly dependent on the nutritional status of females limiting perceptiveness strongly (Strier, 2007) in distinction compared to males where the probability to maximize fitness is in the first instance reached in groups where there are as many perceptive females to mate with as possible (due to the usual lack of support in raising offspring) (Trivers, 1972), food occurrence or access is the driving force behind female sociality.

This difference in the character of social pressures (Wrangham, 1987) stress out female sociality as the more important object of study at this point.

High-level resources affect growth, maturing, and perception intervals (Boyd and Silk, 2009, Lee, 1996). So generally optimal group size and sex composition according to ecological constraints is hypothesized to be the framework for female reproductive strategies and within aspects of social organization. In consequence females are more likely to behave nepotistic in larger groups. Especially females living in multi-male, multi-female groups consisting of their offspring and mature female kin are more likely to behave nepotistic, influencing the prospect of reaching or maintaining optimal group size by being able to regulate it actively via accepting immigration of non-resident males (Silk, 2006). Female groups are in many cases matrilinear organized and reflect in size and composition the outweighed benefits of defending common food resources or minimizing the prospect of being target of a predatory attack (Cluttonbrock and Harvey, 1977, Kappeler and van Schaik, 2002, Wrangham, 1980) and costs of sometimes severe intragroup competition for food (Strier et al., 2006, Crockett and Janson, 2000). More recent studies bearing upon the *Social Brain Hypothesis* by Dunbar (1998) offer insights into probable cognitive constraints on the magnitude of group living (Dunbar, 1992, Dunbar, 1998, Kudo and Dunbar, 2001). According to the social brain hypothesis the size of the neocortex in social mammals, especially in primates is highly correlated to group size, a factor providing information about the upper boundaries of different species' social abilities with respect to the number of possible interaction partners.

Consequently regardless whether the social brain is cause or consequence of constrained sociality in male or female primates from an evolutionary perspective its limiting function is fundamental.

Summarizing at this point, optimal group size is limited by three main variables on the organizational level: ecologic pressures like resource availability in a spatiotemporal context limiting the maximum group size, ecologic pressures like predation or intergroup competition determining the lower bounds of group size, and cognitive constraints limiting maximal group size even in absence of certain ecological effects. This high variability in the influences on group size across primate species is mirrored by the extent to which they differ in the number of conspecifics, ranging from small groups (*Pongo pygmea*) to larger ones (*Theropitecus gelada*) (Chapman and Chapman, 2000).

2.2.3 Social Structure

Leaving aside some of the numerous potential influences on the framework of group organization mentioned above according to the appearance of primate social behavior the intra-specific dependencies of living turn out to be eclectic. As already mentioned, optimal group size and composition result from the struggle between different ecological pressures, namely food acquisition, avoidance of predatory attacks and maximizing individual reproductive success. But according to the inherent mechanistic mode of operation especially according to cohesion and nepotistic agitation in groups these pressures seem to be passive framer rather than active shaper.

This question of structure as a distinct feature of sociality provides deeper insights into the relationships of individuals. The driving force shaping social structure is dominance "producing marked inequalities in access to resources" (Sapolsky, 2005) and implicating different sets of behavioral strategies. These sets are in the following specified as agonistic behavioral traits that equilibrate sociality in the field of intra-group resource competition, social integration and coexistence (De Waal, 1987a).

Leaning on Walters and Seyfarth (1987) the concept of dominance in animals was already introduced by Schjelderup-Ebbe (1935) who showed that agonistic encounters between chickens were predictable in dyadic disputes. These outcomes of different aggressive interactions between chickens draw a picture of a linear transitive hierarchy rooted in and manifested through encounters between dyads of animals holding these different ranks (Walters and Seyfarth, 1987). Today, especially in the context of primates´ performance of aggressive or intimidating behaviors (Sapolsky 2005) a dominance relationship can be defined as one way to harmonize and an predict possible further conflicts and their directions (De Waal, 1987a) that did not evolve through disappearance of competitive and aggressive tendencies in primate behavior, but through the development of powerful mechanisms of conflict resolution (De Waal, 1987a).

In particular the hierarchy can be seen as a strong mechanism itself. Abstracting the strict resource view (Harcourt, 1987, Van Schaik and Van Noordwijk, 1988, Isbell, 1991) to a broader concept of the distribution of resource-dependent variables dominance relationships exert influence on a set of variables such as mating patterns (Boyd and Silk, 2009, Hausfater, 1975), social bonding (Dunbar, 1988), grooming distribution patterns (Seyfarth, 1977) or "grooming markets" (Noe and Hammerstein, 1995) and mortality rates (Boyd and Silk, 2009, Struhsacker, 1987, Pusey et al., 1997). Conflicts thus can result as a consequence of direct competition for resources and indirect competition through ritualized encounters that are rank related and usually do not involve extreme forms. Estimations about the ratio of these two forms suggest that around 75% are due to maintaining the status quo of the rank in the dominance hierarchy itself. This replacement of fierce conflicts through dominance and submission suggests that the maintenance of dominance through ritualized strategic interaction is economically efficient, minimizing individual costs in the framework of potentially excessive intra-group competition (Walters and Seyfarth, 1987).

The extent to which dominance is manifested as well as its appearance again strongly varies throughout the primate social spectrum showing significant biases according to spatiotemporal contexts (Sapolsky, 2004). The focus on the style (De Waal and Luttrell, 1989) as a way capturing the "inherent agonistic asymmetry in relationships and the degree of expressed […] asymmetry" (Flack and de Waal, 2004: 159) of the different species unveils an enormous range in the field of hierarchies. Besides the fact that dominance styles vary between male and female groups of the numerous primate species -a fact that will be referred to later- differences can also be found on the inter- and intra-society level of the same species and in behavioral strategies underlying those structures (Flack and de Waal, 2004, Boehm, 1999, Sapolsky, 2004). In general the most common distinction for dominance styles in social animals as suggested by Vehrencamp (1983) is a continuum ranging from egalitarian (Evans-Pritchard, 1940), relaxed and or tolerant to despotic dominance styles (Flack and de Waal, 2004).

A crucial distinction that has to be made within this context is the concentration of overt aggression. Besides the already mentioned distinction of direct and indirect aggression with respect to resource acquisition, following Vehrencamp the relevant agonistic behaviors have to be evaluated with respect to their absolute concentration on a very few dominant individuals (Boehm, 1999). Leaving aside the structure of behaviors on the nuclear level this asymmetry (Flack and de Waal, 2004) reveals on the one hand in a direct and simple way how strong dominance is exerted or maintained and monopolization of resources is enlarged. On the other hand one can derive that the degree of despotism strongly interacts with group size and group cohesion. This may for example be one reason why harem polygyny in promiscuous breeders is usually limited to 4 perceptive females and that this group structure is not necessarily spatiotemporally consistent (Janson, 1992, Hrdy, 1974, Dunbar, 1988). So even if the direction of aggression or intimidation is opposed in two different societies (intra- vs. extra-group aggression) both dominance styles may be put at one end of the Vehrencamp scale near the despotic extreme. As long as the concentration of dominant behavior is directed at monopolizing resources despotism may be regarded as high in both cases.

Applying the same line of thought the features of extra-group aggression do not necessarily imply that some species' dominance style may not be relaxed. Although relaxed societies always show a reduced concentration of agonistic behaviors guided at monopolizing resources in an intra-group context, individual dominance and submissive behavior as well as pronounced inter-group aggression can be listed as characteristics (Boehm, 1999). These examples reveal Vehrencamp's continuum as a relationship concept that has to be strictly dissociated from corresponding concepts in the social sciences. While nearly all primate species show pronounced dominance behaviors on the nuclear level and with reference to mature female individuals egalitarianism needs not to be excluded.

According to the differences in the dominance behavior in males and females the usual explanatory basis is again rooted in maximizing individual fitness. The main reason for the existence of female hierarchies can therefore still be seen in feeding competition while on the other side hierarchies of male primates are a result of asymmetric access to perceptive females. Male and female dominance hierarchies can thus be regarded as being separated (Packer and Pusey, 1979) to some extend an assumption that eases the examination of the different styles in primate species.

Males in nearly all species of the primate spectrum do dominate females but agonistic interactions resulting in these intersexual relationships are comparably less marked although intra- and inter-sex variations may occur with respect to female estrus cycles (Kappeler and van Schaik, 2002, Smuts and Smuts, 1993, Smuts, 1985).

As a result of intrasexual selection (Boyd and Silk, 2009) in most primate species males' strength, size as well as fighting abilities do play a significant role in the acquirement of ranks in hierarchies while these traits are not significantly implied in the obtainment of females ranks (Walters and Seyfarth, 1987). Male relationships are nearly always characterized by increased competition for receptive females. In many cases the resulting social styles of multimale groups can thus be ranged at the despotic side of the Vehrencamp continuum. Dominance relationships in here are transitive and usually linear although especially coalitionary agitation may hinder structure to seem clearly despotic. Coalitionary support is sometimes seen as a trigger for egalitarianism (Kappeler and van Schaik, 2002, Strier, 2007, Boehm, 1999, Sapolsky, 2005), but with regard to social power as defined by Flack and de Waal (2004) this may be confusing.

Male-male competitive behavior and the resulting dominance styles in cercopithecine are very variable. While rank acquaintance is in sometimes age reversed in multi-male groups this need not to be a general rule (Smuts, 1985).

Since male baboons and macaques usually do monopolize breeding in the harem scenario and direct fierce aggression towards incumbents these species must be placed at the despotic side of the Vehrencamp continuum. Others again show no such pronounced dominance behaviors (Flack and de Waal, 2004). Whether strategy spaces of male cercopithecine species contain behaviors that seem more relaxed or not, egalitarianism used as a term characterizing male dominance styles (Matsumura, 1999) might end up in confusion. If at all some baboon and macaque species may be noted as being more relaxed while most are certainly despotic (Flack and de Waal, 2004).

Female relationships tend to be more nepotistic in groups where females philopatry is the rule. The corresponding social structures are temporally highly consistent with pronounced linearity although the degree of exerted dominance is by no means as despotic or despotic at all in comparison to the numerous male-male relationships. Whenever on the other hand females do disperse the tendency to establish time-consistent hierarchies declines.

Especially in multi-female groups female philopatry is suggested to induce tight matrilinear hierarchy styles (Silk, 2007). Within the group, mothers always outrank all daughters. Female kin in these cases usually acquire the rank just below their mother when they get older. A stepwise decrease in the rank of immature female kin is associated with newer born maturing siblings, a strategy leading to the occurrence of linear ranking inversed to the age structure of the group (Silk, 2001). Outside the group all females of one matriline outrank the members of matrilineages being subordinate. The acquisition and maintenance of the dominance ranks is mainly due to high tendencies to form coalitions between mothers and their daughters although this may not be true in all cases (Matsumura, 1999). Mothers even support their immature offspring in agonistic conflicts such that it is possible that juveniles outcompete mature females in agonistic intragroup-conflicts (Walters and Seyfarth, 1987). In Macaques and Baboons female primates' ranks seem to be quite consistent over time, suggesting that mature females in many cases loose the acquired rank not until the end of their life (Boyd and Silk, 2009, Walters and Seyfarth, 1987). Dominance styles herein can differ extremely. They range from more relaxed styles to highly despotic styles (japanese macaques) (Matsumura, 1999, Sapolsky, 2005).

Throughout the hominid species where female philopatry is anything but common the dominance styles still do not differ significantly. Female bonobos living in large multi-male multi-female fission-fusion communities disperse with maturity. Nonetheless females exert strong dominance behaviors in female hierarchies and tend to form powerful coalitions (de Waal, 1995). As a result in bonobo groups there may exist co-dominance of genders (Wrangham and Peterson, 1996) in particular alpha males and alpha females both involved in female coalitions. Although the extent to which dominance is exerted in agonistic interactions is not as extreme as in other species, the coalitionary power underpinning the rank of some individuals may be seen as another form of concentration of dominance and thus characterize bonobo females' hierarchies as semi-despotic (Boehm, 1999).

Female chimpanzees live in groups being quite comparable to those of bonobos on the organizational level. Just as the males female chimpanzees do organize in parties, subgroups that are temporarily unstable and constantly change their composition. Although female chimpanzees are dominated by all mature males in dyadic interactions such that there is no alpha female of the whole community hierarchies in female groups are common. Agonistic conflicts are less fierce than in male chimpanzees but the political power exerted by female coalitions on the macro-level of the community may be deciding. Females' coalitions are in consequence sometimes even involved in the rivalry of males for a higher status impinging on the results of agonistic conflicts (Boehm, 1999). Although power in female individuals in chimpanzee societies is not that concentrated the correlation between female rank and reproductive success (Pusey et al., 1997) is significant. Furthermore newer studies may have found evidence for at least some linearity in females' hierarchies (Wittig and Boesch, 2003).

The occurrence of certain epiphenomena (linearity of hierarchies, coalitionary agitation) accompanying status rivalry, induce that dominance plays a role in chimpanzee female hierarchies. This may characterize them as being comparably relaxed. The question if structures can be described as being looser than in male hierarchies (Boehm, 1999, Stumpf, 2007) is, with respect to the higher political power exerted by female coalitions problematic.

In the patrilocal societies of chimpanzees and bonobos mature males structure in dominance hierarchies. Grouping in parties is well-marked especially chimpanzee males leading to higher ratios of intra-group associations. In chimpanzee societies the alpha male controls the group, agonistic interactions often caused by the alpha (Muller, 2002) are rank related to a vast extent, and every mature male dominates every mature female (Wrangham and Peterson, 1996). The hierarchies show pronounced linearity and transitivity (Stumpf, 2007). In bonobos on the other side and as already mentioned societies consist of co-dominant individuals and male hierarchies are rarely linear or transitive. Much of male dominance is due to coalitionary support from female subgroups that are kin related (Nishida and Hiraiwa-Hasagewa, 1987). Since bonobos do not affiliate in male coalitions political power is not skewed towards alpha males (Boehm, 1999). With regard to social power the differences between male bonobos and male chimpanzees may not seem that distinctive. But according to direct rank related intergroup-aggression territorial behavior patterns in chimpanzees contrast from bonobos explicitly. Chimpanzees are highly territorial a feature including lethal raiding of competing neighbor groups (Wrangham, 1999). This feature of chimpanzee behavioral strategies is exceptional and suggests chimpanzee males to be very despotic and bonobos to be semi-despotic.

2.3 Sociality in Humans

Primates show pronounced and highly complex pro-social behaviors. This is a key fact distinguishing these species from most other mammals and going far beyond the concepts of competition through aggression in agonistic, dyadic interactions (Lewin and Foley, 2004). The underlying strategies are so wide-ranging and variable that it is nearly impossible to deduce the patterns and rules of human behavior thereof. Human behavioral strategies themselves are a good example for a degree of adaptability that makes it hardly possible to derive anything more from it than that humans are indeed quite adaptive.

So even without using the sometimes hypothetic evolutionary dynamics, and with reference to primate societies differing mechanisms for sociality in humans one can find many diverse social organizations, structures, and styles only in the homo spectrum. A good summary for this diversity already on the nuclear level of human mating strategies is provided by Boyd and Silk (2009):

> "During the first half of the twentieth century, cultural anthropologists fanned out across the world to study the lives of exotic peoples. Their hard and sometimes dangerous work has given us an enormous trove of information about the spectacular variety of human lifeways. They found that domestic arrangements vary greatly across cultures: some groups are polygynous, some monogamous, and a few polyandrous. Some people reckon descent through the female line and are subject to the authority of their mother's brother. In some societies, married couples live with the husband's kin, in others they live with the wife's kin, and in some they set up their own households. Some people must marry their mother's brothers' children; others are not allowed to do so." (Boyd and Silk, 2009: 424)

According to Dunbar the investigation of the roots of human sociality can occur in three ways:

1) the extraction of analogies between nonhuman primates and extinct hominids
2) a comparison of living primate species aimed at extrapolating general rules and mechanisms of behavioral patterns
3) modeling populations' evolution in varying environments when certain behavioral strategies are constrained (Dunbar, 2001).

While the first way although being the most prominent one throughout the last 30 years is supposed to confuse rather than ease the attempt of disentangling the possible behaviors of hominids, whether extinct or not. The other two approaches may be helpful and offer better guidance in current research (Dunbar, 2001). It is not surprising that recent hypothesis about sociality and social complexity in primate species are products of the latter two approaches. By comparing group size in multiple mammal species with neocortex size of the associated individuals Dunbar (1998) weighty influenced the shift towards an investigation of the "Man the Social Animal" (Lewin and Foley, 1998: 220). And by modeling evolutionary dynamics of reciprocity in sizeable groups to cite only one newer example, Gintis (2000) offered insights into constraints that may have framed and shaped reciprocity.

Human sociality today is varying strongly even when compared to the social styles found in the primate spectrum. It is commonly assumed that this must be due to ecologic pressures framing sociality in its foundations. While this assumption is true for the general mode of existence of sociality in humans this is only part of the explanatory basis for the huge diversity of societies with reference to its structures.

First hominins probably lived in patrilocal polygynous groups. Sexual dimorphism of our extinct ancestors was highly marked leading to the assumption that intra-group competition in the multimale scenario lead to enhanced intrasexual selection (Boyd and Silk, 2009, Wrangham, 2001). It can be assumed that dominance styles were comparable to those of chimpanzees (De Waal, 2001). Estimations about the group sizes of extinct hominini in comparison to chimpanzees assume around 60 individuals in Australopithecine groups, a number steadily increasing throughout the different homo species up to 150 in modern human groups compared to chimpanzees where 55 individuals can be assumed on average in a society (Dunbar, 2001). Since the features of sociality in the early hominini according to structure, organization and mating styles do not differ significantly from those of non-human primates the question arises how and why distinct human sociality and the enormous adaptive potential inherent to it arose.

2.3.1 The *Environment of Evolutionary Adaptedness*

> "Human nature consists of a mixture of ancient mammalian traits, general primate traits, and specific traits exhibited by hominoids". (Boehm, 1999: 12)

The *Environment of Evolutionary Adaptedness* (EEA) (Barkow et al., 1992) is referred to as the transition phase in the hominid evolution ranging from 1.8 million years (lower

Pleistocene) to 10.000 (upper Pleistocene) before present. This phase is characterized by many climate changes that forced socially and technologically developed humans to adapt to changing environments and establish living in mobile small-scale foraging societies (Boyd and Silk, 2009). Today's foraging societies are supposed to be a structural equivalent to societies of the EEA and are thus often referred to by many authors (Kaplan et al., 2000, Boehm, 1993).

It is important to note at this point that the term adaptation in this regard may lead to confusion. As Wrangham states the degree of sexual dimorphism, absolute body size, as well as many other physical characteristics did not undergo significant changes in humans throughout the last 2 million years. He hypothesizes that this may in consequence imply that all humans in this period faced the same "basic system of social ecology and sexual selection" (Wrangham, 2001: 143). If this theory is correct adaptations in this context are rather based on changing patterns of sociality than on "conserved" morphologies.

This focus on factors influencing social abilities in humans is even underlined when regarding the development of the brain size in mammals throughout the last 3 million years, the only factor that underwent significant changes in hominins. Dunbar (2001) argues that hominins average brain size in this period increased from about 400 cc (*Australopithecus africanus*) to 1350 cc (*Homo sapiens*). Since brain size inducing behavioral strategy variability through "learning, cognition, and insight" (Kaplan, Lancaster and Hurtado, 2000: 156) is the only major measurable morphologic difference and ecologic pressures did not impact on this change, again as stated above, questions about this "human nature" can rarely be answered homologous to the non-human primate spectrum.

Brain size is highly correlated to especially two key features, the mother's metabolic rate and the length of the gestation period . While the gestation period for humans is with about 270 days comparable to the ones of hominoids, there are significant differences according to body size to brain ratio of the newborns. Human newborns' brain- and body sizes are in comparison to anthropoid species around two times as large and grow throughout their lifespan to a size that is 3 ½ times bigger. The total energy devoted for fetal offspring as well for the maturing juvenile thus must be markedly higher in humans than in anthropoid species. The same must then also hold for the metabolic rate of the mothers (Lewin and Foley, 2004).

Throughout their lifespan the brain to body ratio significantly skews. Mature humans have brains that are three times as large as the ones of anthropoid monkeys and apes while exhibiting comparable body sizes on average. It is straight forward that when body sizes of mature individuals are equal while brain sizes differ, much of the total energy devoted for brain growth must be skewed toward in humans. This is especially true with respect to the fact that brains of newborn humans undergo a one-year postnatal period of rapid growth expanding the gestation period to 21 months and that higher intelligence implies longer periods of valuable learning (Lewin and Foley, 2004).

The metabolic rate of the mother can therefore only be one aspect that has to be accompanied by a sufficient supply of high energetic food resources for the maturing offspring. Consequently selective pressures towards increasing brain sizes must have been promoted by abilities to guarantee relatively constant high energetic food supply. Whether this supply through abilities is rooted in drastic changes in the diet (Carmody and Wrangham, 2009) or not it is obvious that more complex patterns of social abilities matter at this point.

Most generally three points seem to be quite influential here, a change in food composition, the evolution of long-term bonding between males and females and labor division between sexes (Kaplan, Lancaster and Hurtado, 2000). While bonding can be seen as maximizing fitness behavior on the individual level of males since dependencies of mothers and their offspring increase for a longer period, the other two points seem to be more crucial for human evolution in the EEA. Higher energetic demands must yield higher energetic supply. If maximum supply is held constant throughout the Pleistocene, a relaxing assumption with respect to rapid climate changes in this period, higher demand can only be saturated by an increasing efficiency in food acquaintance or food refinement.

A comparison of food acquisition in chimpanzees and humans offers insights into the grounding mechanisms of proposed efficiency gains. In chimpanzee populations collected foods take up the hugest amount of time spent for feeding. Extracted and hunted foods as a consequence do not make it up to more than 5% of feeding time on average. In human foraging societies on the other side most of the diet is either hunted (animal game) or extracted (tubers) while collected foods are less important (Boyd and Silk, 2009; Kaplan, Lancaster and Hurtado, 2000).

This change in the composition and quantity of food available strikes out hunted and extracted foods as main food sources. Hunting for large game as one major calorie supplier to this extend must have been performed collectively in the EEA. Furthermore refined hunting and gathering techniques afford time seeking learning effort yielding in specialization. And since immature offspring in humans is highly dependent for years a sexual division of work might have been established in the EEA (Rubin, 2002).

Boyd and Silk (2009) run an example underlining the probability of the assumption of collective hunting. While this example is leaned at the “stag hunt” game motivated by Rousseau the authors differ in their model in a distinct way: it is possible to starve from hunger if game is not successfully hunted. The difference to chimpanzees who themselves engage in cooperative hunting is not striking when compared to this feature itself. The point is that with increasing importance of meat for higher energetic supply, on the one hand hunting styles must have become more efficient and technologically dependent while on the other hand the frequency of sharing large packets (Kaplan, Lancaster and Hurtado, 2000) of the hunted game sharply increased. With reference to the more complex foraging methods that can inherently be assumed to constitute the efficiency gains Boyd and Silk conclude that brain growth and extended maturing periods for this purpose were favored by selection. As a result the emergence of a higher, cumulative human culture (language, religion, technologies) as distinct from the usually defined culture as the mode of social information transmission and retention is supposed (Lahr and Foley, 1998, Lewin and Foley, 2004, Foley and Lahr, 2003). The increasing frequency of sharing however poses a starting point for the theory of the non-genetic evolution (Kaplan, Lancaster and Hurtado, 2000) or *gene-culture coevolution* (Cavalli-Sforza and Feldman, 1981, Kaplan and Gurven, 2005) theories aimed at paving the ground for the exploration of sociality in modern humans as I will show in the following chapters.

According to these ideas most of all it is socially learned strategic behavior framed by cultural pressures which is the driving force behind complex pro-social behaviors (Richerson et al., 2003). Several authors hypothesize that from the moment on in which humans reached a certain point of intelligence they established a level of complex societal arrangement that itself afterwards internalized pressures on individuals (Lewin and Foley, 2004). These selective pressures were “cultural” and thus distinct from natural selection probably leading to adaptations in humans such as specific emotions or cheater detection abilities (Cosmides et al., 2010) stabilizing cooperative strategies in societies. But in sizeable groups where the number of related individuals surpasses the number of unrelated ones and cooperation is face-to-face the rules for cooperation must significantly differ (as can be seen in chapter 3).

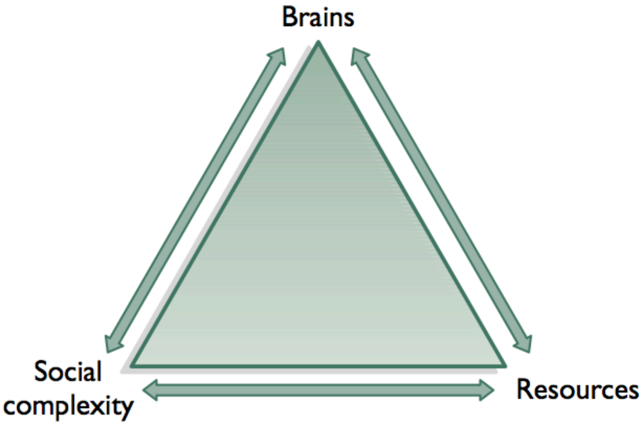

Figure 2: The interdependencies between intelligence (Brains), sociality and group size (Social complexity), and ecology (Resources): all three variables depend on each other resulting in numerous feedback loops. Size and amount of resources in patches impinge on group size and promote a possible evolution of larger brains, allowing for complex societal arrangement in larger groups (Lewin and Foley, 2004: 458).

Cultural evolution must have furthermore lead to adaptations allowing for mutuality in groups where kinship and thus indirect fitness gains are not the driving force behind prosocial behaviors. The evolution of indirect reciprocity (Nowak and Sigmund, 2005) or the hypothesized evolution of strong reciprocators (Gintis, 2000), are the core concepts of behavioral strategic evolution in the EEA with respect to sociality. The notion today is that especially contemporary mental abilities of humans are relicts of the EEA. Since brain evolution is a protracted process human societies and human social behavior are supposed to be adapted to technological, ecological and social conditions (Boyd and Silk, 2009) of the upper Pleistocene (Foley and Lahr, 2003).

Hominids that lived in the Pleistocene are usually supposed to have exhibited forms of sociality that are much like those of contemporary nomadic hunter-gatherers. Humans therefore lived in small-scale societies or bands of up to 150 individuals with shared cultural and linguistic traits. Labor was sexually divided into hunting males and gathering females both exhibiting relatively high degree of work specialization. Property was relatively uncommon since production was minimized on the subsistence level. Sharing especially large packets of hunted meat in the group was daily routine. And in connection with labor division it may be counted as an influencing variable for a decrease in the degree of competition between males and a reduced degree in the sexual dimorphism of existing humans (Boyd and Silk, 2009). As a result and with respect to most forager societies existing in present times it is hypothesized that upper Pleistocene societies were basically egalitarian, agitating politically on a communal basis in which hierarchies where existent but rarely linear (Boehm, 1999, Boehm, 1993, Knauft, 1991). This phase may also have triggered the emergence of distinct production and consumption hierarchies as argued by Rubin (1999). Although this assumption complicates the classic examination of social structures in human societies this approach not only seems to be applicable but also may in fact disentangle the possible forms of contemporary hierarchies facilitating future research.

Considering egalitarianism in foragers it is noteworthy at this point that it is the men who usually control the societies on the macro level. And although this governance style may be egalitarian, neither exerted dominance on the nuclear level of the family nor sometimes severe competitive agonistic conflicts for females induce this dominance style (Boehm, 1999). In fact the decrease of competition for food is not generally linked with a decrease in competition for perceptive females. Consequently although the emergence of culture, emotions and moral communities in the EEA may have triggered important psychological as well as physic barriers that may minimize the probability of fierce competitive conflicts the main cause of homicide in hunter-gatherers is competition for females (Knauft, 1991; Boehm, 1999). Boehm (1993) argues that the social structure of those societies can therefore be best described as reverse dominance hierarchies, dominance hierarchies that may seem egalitarian but exert in fact strong dominance behaviors. Sets of these strategies contain a variety of behaviors from submission over ostracism to targeted killing of deviants.

Early forager societies can thus be placed at the more despotic side of the Vehrencamp continuum although tendencies for egalitarianism on the macro level of the society are strong.

2.3.2 Human Social Structure

The hominoid spectrum offered insights into the dynamics of the roots of competition between individuals. This might give hints about the nature of human cooperation driving out competition in social dilemma situations. Humans especially in western societies today -in times of plenty- seem to have gained the ability to overcome some main causes of competition among themselves, namely the competition for food resources.

Many authors suggest that the environment of evolutionary adaptedness shaped contemporary humans strongly and that our behavior is still suited to ecology and sociology of the upper Pleistocene (Barkow et al., 1992, Henrich et al., 2001, Wallner et al., 2008). It is obvious that humans must have specific abilities leading to cooperation in sizeable groups. Some of these abilities already have been characterized and will be sketched in the upcoming chapter. Due to the main assumptions according to the results of the gene-culture co-evolution one must assume that there is and was significant selective pressure on humans living in societies, shaping cooperative abilities.

One can hypothesize according to group selection theories that societies today selectively force humans to cooperate in a framework, where competition would lead to inefficient outcomes in the long run (Boyd and Richerson, 2009). The invention of culture aimed at enforcing norms and rules thus might itself have led to pressures selecting certain cooperative player types. The more research about the foundations of human sociality is done the more obvious it gets that cooperative abilities do counteract the classic rationality driven assumptions towards human strategies in a lot of social dilemma situations. But still there is a lot competition between humans in contemporary societies and humans seem to have adopted evolutionary old social structures to the use of new ones in form of production hierarchies (Rubin, 2002). This is important with regard to human development throughout the last 10.000 years. It is not clear whether humans could significantly adopt in this period of time and i will not start discussing this issue in the following. But with respect to the questions how dominant contemporary humans indeed are or may be and why present lives are so diverse, socially as well as economically, it is noteworthy to address at least some more lines to the switch from mobile foraging societies to sedentary societies in the Neolithic.

Knauft (1991) suggests that the development of dominance in humans followed a u-shaped trajectory over time with strong tendencies towards despotic dominance styles at the beginning and the end of the time-line. The minimum point with the highest possible egalitarian lifestyles in hominins is placed at the end of the Pleistocene. Whatever society followed afterwards, chiefdoms, kingdoms, or modern societies dominance styles appeared to be more despotic (Boehm, 1999). It is this „universal drive to dominance“ that must have been the nature of mobile hunter-gatherers in the Pleistocene as well (Eibl-Eibesfeldt, 1979). Plant and animal domestication and the rise of sizeable societies in the Neolithic were characterized by individual property, trading and increased intergroup competition that lead to inequality. Whether this is intra-group inequality like social status or inter-group inequality as proposed ground for group selection theories these asymmetries may have strengthened despotism through displacement and elimination in the past.

Today we live in multiple hierarchies (Sapolsky, 2004), not just production or consumption hierarchies, or male and female hierarchies. And although there are concepts dealing with the status or rank of individuals in modern societies (Marmot *et al.*, 1978), hierarchies in economics (Williamson, 1975), or social dominance in humans from an evolutionary perspective (Hawley, 1999). The asymmetry inherent to individual and coalitionary dominance behavior and its causes, always being framed by hierarchic settings characterizing social power in groups is a factor that has not undergone much attention. Humans exhibit a very high variation of agonistic and cooperative behaviors. Usually scientists exploring the roots for sociality in human societies regard both behavior sets independently from each other. But trade offs must be expected. Social structure certainly does impinge on cooperative or competitive behavior. Steep and sometimes transitive hierarchies of contemporary societies are either a quite old or a very new and unique form of human sociality. It is thus not just disentangling cultural and innate predispositions for cooperative behavior but as well recognizing and explaining when and especially where (in what structure) competition drives out cooperation (after cooperation has driven out competition from an evolutionary point of view).

3. The Evolution of Sociality – Cooperation of Humans

The following subchapters first of all introduce the core concepts of evolutionary game theory and biology about sociality and thus especially cooperation in individuals. Note that kin selection as the universal concept of cooperation on the nuclear level of the family is a common feature to all social animals is not referred to in the upcoming sections. These sections are rather supposed to explain the distinguishing character of human social abilities.

Second, after having introduced the most common experimental settings used in behavioral economic research, some main findings and assumptions about economic agents will be summarized. This chapter will end up classifying four types of players that are hypothesized to serve as an ultimate characteristic for agents having other regarding preferences. These characteristics will in the following chapter 4 serve as basis for a critical assessment of how behavioral economists integrate their *social preference* approaches into the framework of behavioral ecology and evolutionary biology.

However this work does not target to question the main findings of behavioral economics. Rather than that especially chapter 3 most generally aims at stressing out that the investigation of agents cooperative abilities and a classification of behavioral strategies is of big importance. As will be shown in the next section it is more the interpretation of the strategies economic agents apply which is questionable, both, from the perspective of evolutionary anthropology but as well from contemporary economic theories about agents.

3.1 Five Rules for the Evolution of Cooperation

Game theoretic research offered and still offers deep insights into the understanding of mechanisms that allow for cooperation and thus sociality. Nowak (2006) surveys the relevant mechanisms determining the evolution of cooperation. He proposes five mechanisms as being fundamental for the evolution of cooperation (see fig. 3). While especially the first three do in fact rule cooperation as being embedded in social interactions the latter two are rather guided at the macro-level of sociality and its consequences on the framework for cooperation.

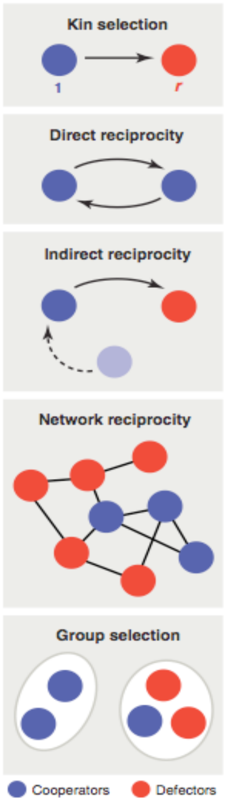

Figure 3: Five Rules for the Evolution of Cooperation (Nowak, 2006: 1562).

Kin Selection

The first mechanism is stated as Hamilton's rule (Hamilton, 1964). It refers to the concept of kin selection and formalizes its mode of operation as follows:

(1) $r > c/b$

The relatedness coefficient (r) must be bigger than the cost (c) - benefit (b) ratio to allow for an altruistic act. The grounding idea according to the value of r is that relatives with a high probability share a certain amount of alleles increasing with the degree of relatedness (Hamilton 1964). Thus on average sisters share about 50% of the alleles (r=0,5), nephews about 25% (r=0,25) and cousins 12,5% (r=0,125). The idea stated in the survey with respect to Haldane that someone risks his own live to save two brothers or eight cousins (Haldane, 1955) is the most prominent metaphorical characterization of this mechanism. But it also strikes out the strong limitations of kin selection theory as it is solely directed at maximizing inclusive fitness on the nuclear level of social structures providing a relatively high degree of relatedness. Altruism for example in form of nepotism (Silk, 2006) in this sense is therefore a misleading term for behavior revealing selfishness as major force behind it (Dawkins, 1976).

Direct Reciprocity

The second mechanism that is referred to is *reciprocal altruism* (Trivers, 1971) or *direct reciprocity* (Nowak, 2006). Direct reciprocity as a mechanism may lead to cooperation above the nuclear level of the family in repeated interactions where relatedness does not play a role. In its formalization (2) the relatedness coefficient, r, is replaced by w, the probability of another interaction between two individuals. So the probability of interacting again must surpass the cost to benefit ratio of a reciprocal act.

(2) $w > c/b$

In this setting cooperation takes place between a donor and a recipient. (2) provides hints about the general ideas connected to this mechanism. First of all, a donor faces costs in the one game while the recipient benefits. Second the average benefits of recipients must exceed the average costs of donors. And third, there cannot be an outside option (De Waal and Brosnan, 2006).

But by leaving aside relatedness as major explanation for inclusive fitness gains through cooperation the question arises why individuals should interact cooperatively with non-relatives. As mentioned, already non-human primates do have „machiavellian“ intelligence (Byrne and Whiten, 1988) allowing to mirror causes and consequences of interactions with conspecifics. Cooperation in this respect may not be a best response when cheating is payoff-dominant and selfish individuals form expectations. The emergence of direct reciprocity introduced as a mechanism therefore strongly impinged on the investigation of strategies sustaining cooperation in repeated games between dyads of players (Nowak, 2006). Axelrod's (1984) *tit-for-tat* strategy still is the most famous evolutionary stable strategy (ESS) for repeated interactions guaranteeing zero or slightly positive payoffs for cooperators in games where they face defectors.

To see this suppose a game played repeatedly by a cooperator using *tit-for-tat* strategy and a probable defector. The average number of rounds played is given by the term 1/(1-w). If both defect in the first round, payoffs will be zero. One-sided cheating in the first round yields all in all payoffs for the defector of b and a payoff for the cooperator of –c. Two-sided cooperation in the first round yields payoffs for both in the amount of (b-c)/(1-w). It is easy to see that *tit-for-tat* is an evolutionary stable strategy for cooperators in this game if and only if $w > c/b$ holds while *always defect* is ESS in any case. (2) in this respect is a "necessary condition for the evolution of cooperation" (Nowak, 2006) of but it is far from being sufficient.

In the end the evolution of cooperation through direct reciprocity as proposed by Trivers (1971) is a general rule paving the way for pro-social behaviors but is as well highly constrained by the applied strategies of interacting individuals.

Indirect Reciprocity

Since kin selection and direct reciprocity do need at least some proximity between the interaction partners, either by relatedness or spatial nearness, both approaches can explain cooperation in small societies but fail to do so when group size increases at least to a medium size. The proposed mechanism of *indirect reciprocity* (Trivers, 1971, Alexander, 1987, Nowak and Sigmund, 1998) offers a way out of this dilemma. Implementing reputation as mechanism enforcement device, Nowak and Sigmund (1998) isolated evolutionary stable strategies when *indirect reciprocity* is the rule. Reputation is measured by "image scoring", yielding to one-point increases in the score for every cooperative interaction and equivalent decreases for every defection. Reputation in form of positive or negative image scores is a measurable index for an individual's preferences to cooperate (Ohtsuki and Iwasa, 2004). By implementing this measure Nowak and Sigmund were not just able to overcome the problem relatedness or nearness but specifically the problem of immediacy and face-to-face mutuality of pro-social acts.

It is far from being the norm that cooperation is valued equally from both interaction partners, an assumption that is congruent with the case of *direct reciprocity*. Thus in the standard setting of game theory dealing with *indirect reciprocity* there is again always a donor who decides whether or not to cooperate with a recipient. But with this indirect mechanism this is because the need for cooperation usually depicts some asymmetry between the needs of donating and the needs of receiving help in spatiotemporal contexts. If an individual is supported in any way by a donor it is neither assured that it is able to give back skilled help to the same person at all nor is it assured that they both ever meet again to eventually have the possibility to reciprocate.

The core of indirect reciprocity is therefore rooted in what Trivers (1971) called third party altruism. You are willing to cooperate if your partner cooperated before with others. And since you might not know her personally and do not know if she cooperated ever before what is of interest for you is her all in all reputation. "Direct reciprocity is like a barter economy based on the immediate exchange of goods, whereas indirect reciprocity resembles the invention of money. The money that fuels the engines of indirect reciprocity is reputation." (Nowak, 2006: 1561)

Here two questions arise. First of all and this is more relevant at this point, reputation must be an available information. Leaving aside the manipulative skills of humans, the evolution of language might be an important trigger for indirect reciprocity allowing for reputation (Nowak and Sigmund, 2005). If actions are not observable what matters is the probability that someone is behaving more cooperatively or if he is a cheater. Replacing w in (2) by q, the probability to know the reputation of an interaction partner, *indirect reciprocity* can be formalized as:

$$q > c/b$$

The probability to know the recipients reputation must surpass the cost to benefit ratio of the reciprocal act (Nowak and Sigmund, 2005).

Direct and indirect reciprocity prove to lead to identical payoffs for both players under certain circumstances. So for $q=w$ and $q \rightarrow 0$ evolutionary stability is reached in both mechanisms by the same strategies. For all other values Nowak and Sigmund (1998) found especially two strategies promoting cooperation when image scores are not necessarily positive: *And* as well as *Or* strategies. Evolutionary stability in the indirect reciprocity setting can result from strategies prescribing cooperation if my score is low and my opponent's score is high (*And*-strategy) as well from strategies prescribing cooperation if my score is low or my opponent's score is high (*Or*-strategy) (Nowak and Sigmund, 1998; Ohtsuki and Iwasa, 2001).

Second with reference to a problem stated by Leimar and Hammerstein (2001) image scoring may be inappropriate when a cooperator faces a defector and punishes him to the good of the society. This question of cooperation supporting second stage mechanisms such as punishment, social preferences or coalitionary effects is quite important. Especially with respect to sizeable societies evolutionary stable strategies leading to cooperation do not work without support. I will later refer to this problem in detail.

Network Reciprocity

So far the enumerated mechanisms can be characterized as "rules of the game". All three mechanisms constrain the evolution of cooperation and embedded possible evolutionary stable strategies by appealing to players' decisions to participate in pro-social interactions. But since probabilities to interact in populations are not uniformly distributed and cooperation probabilities are always biased towards individuals in dynamic networks, *network reciprocity* deals with mechanisms allowing reciprocity where strategies or motivations can be disregarded (Nowak, 2006).

Network reciprocity highlights the dynamics of the evolution acting on populations with respect to spatial structures capturing different setups of "playboards" on which for example pro-sociality may emerge and manifest (Lieberman et al., 2005). The setups for spatial games thus are different forms of lattices. Individuals (players) are randomly placed on the vertices of the lattices and have an average number of nearest neighbors, k, to interact (or just infect) with. Ohtsuki *et al.* (2006) propose that cooperation may be ESS if equation (4) is valid.

(4) $b/c > k$

For each individual of the population the number of possible neighbors (or interaction partners) (k) must be surpassed by the benefit-cost ratio of potential altruistic acts.

Group Selection

Since group selection theory was and still is a quite controversial topic I will not go into much detail at this point. Recent analyses show that *multilevel selection* may exist and that it has played an important role in the evolution of cooperation in sizeable groups (Gachter and Herrmann, 2006). According to this theory selection pressures can also act on groups leading to intergroup-competition. This mechanism leads to cooperation being ESS if (5) holds.

(5) $b/c > 1+(n/m)$, where b/c is the benefit-cost ratio, n is the maximum group size, m is the number of groups

Some authors refer to this mechanism as being culturally dependent (see Gächter and Herrmann, 2006; Nowak, 2006). As was noted in the abovementioned explanations, many different equilibria in varying spatiotemporal contexts may exist, from pure-cooperation equilibria to always-defect equilibria and in between numerous mixed ones. In consequence it is possible that different societies level off at different equilibria and temporarily coexist. In the long run it is supposed that displacement effects lead to increasing competition and finally an extinction of most of the competing societies. The grounding inter- as well as intra-group pressures are usually referred to as selective cultural pressures. These are hypothesized as being rooted in the gene-culture co-evolution.

3.2 Cooperation in Humans

Usually contemporary research does not focus on kin selection in humans. On the one hand, this may be due to the fact that modern, sizeable societies cohere although the number of unrelated group members surpasses the number of related ones by far and on the other this may be due to the fact that the mechanism is no unique human feature working on the nuclear level of families as can be seen in the previous paragraph (Fehr and Fischbacher, 2003). Experimental research more likely focuses on direct and indirect reciprocity as well as 2nd stage mechanisms that are supposed to support and stabilize cooperation under these rules. Although kin selection as cooperation enforcement device may be of economic interest for example with regard to family business performances in markets (Schulze et al., 2003) I will also not refer to this mechanism in this work. Furthermore the mechanisms of group selection as well as network reciprocity will not be included into an overview of economic experiments and results. Both fields are yet too unexplored and still show much heterogeneity. Presumably they will rarely provide grounded findings for a satisfying examination of pro-social behaviors in humans.

Research in the fields of game theory and experimental economics has increasingly focused on two main questions since the nineteen eighties. On the one hand especially evolutionary game theorists want to understand the evolutionary dynamics and strategic variability in different social species and especially figure out why humans are able to maintain cooperation in large-scale societies (Axelrod and Hamilton, 1981, Boyd and Richerson, 1988, Boyd et al., 2003). On the other hand experimental economists, coming up with evidence for agents being not as self-interested as expected by neoclassic theory, try to evolve the rationality driven homo oeconomicus approach (Camerer and Fehr, 2006, Gachter and Herrmann, 2006) with the aim to sharpen the understanding of incentives as driving forces of both market competition and cooperation (Fehr and Fischbacher, 2005).

In applying the same methods in their investigation of analogous behavior patterns in humans up to today both disciplines show significant similarities. With this in mind it is not surprising that in some cases the line between evolutionary game theory and experimental or behavioral economics becomes blurred and interdisciplinary research in form of field experiments as most prominently done by Henrich *et al.* (2003) emerges.

The most common way for doing research about social strategies is laboratory or field experiments. Although especially Elinor Ostrom (2005) proves that market observations can be a fruitful approach towards an examination of human cooperative behaviors, experiments and mathematical modeling allow more detailed insights into the mechanics of decision making since external influences can be controlled for. Experiments are usually modeled in a way that it is possible to extract information that are both applicable to real world situations (isomorphism principle), and spatiotemporally congruent (induction principle). Experiments therefore not only allow to isolate for external effects in laboratory contexts but also to explore the roots of sociality by distinguishing between cultural adaptations and innate cooperative traits. Models indicate that without any 1st stage mechanism cooperation can never be an evolutionary stable strategy and will be displaced in the long run (see fig. 4).

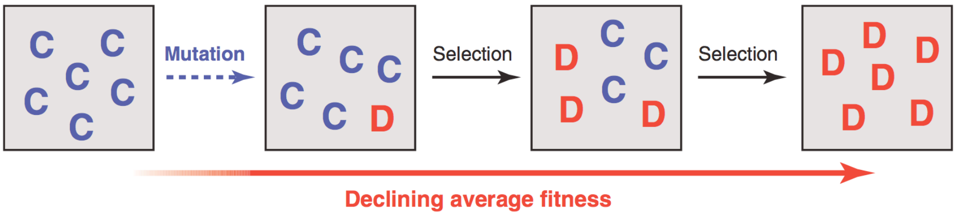

Figure 4: The five mechanisms constraining the evolution of cooperation (Nowak, 2006: 1560) Natural selection will always favor defectors instead of cooperators if no mechanism supports the evolution of cooperation in groups of conspecifics.

But even after regarding mechanisms like kin selection or direct and indirect reciprocity, any cooperative outcome is far from being evolutionary stable over time if group size increases. Fehr and Fischbacher (2003) run simulations of multi-player prisoners' dilemmas for 2000 generations, varying group size from 2 up to 512 players. As a result in groups that are merely ruled by reciprocity cooperation already breaks down in groups containing more than 16 members. So as already indicated when introducing reputation as a variable that can stabilize cooperation in section 3.1, pro-social behaviors under the rules of reciprocity or kin-selection itself cannot solely trigger sociality in sizeable groups. In the following sections I will therefore in a first step introduce key facts about 1st stage mechanisms (Nowak, 2006) and corresponding human behaviors as well as 2nd stage mechanisms like reputation (Nowak and Sigmund, 1998), direct and indirect punishment (Fehr and Gachter, 2000, Fehr and Gachter, 2002) or the resulting hypothesized *social preference* approaches (Fehr and Fischbacher, 2005) in different experimental settings. Findings and interpretations mainly lean on two review articles, one published by Gächter and Herrmann (2006) and the other one by Fehr and Fischbacher (2005).

3.2.1 Experimental Designs

The usual experimental designs for investigating cooperation through direct and indirect reciprocity are the Prisoners Dilemma (PD), Public Good Games (PG), and Ultimatum Games (UG). All games have been studied extensively such that the following restatements are only depicted in brief.

The typical symmetric prisoners dilemma as introduced in Camerer (2003) provides a framework for dyadic interactions. Both players choose to cooperate or to defect without observing the opponents decision. Mutual cooperation payoffs (c) exceed mutual defection payoffs (d). If mutuality fails, the payoff from defection (f) exceeds the payoff of cooperation (e).

In PD games it holds that $f > c > d > e$ such that defection is always a best response in one shot games and mutual defection leads to pareto dominated equilibrium payoffs $(d,d) < (c,c)$. In the one shot game individual rational behavior should therefore always rule out collective rationality. With respect to the direct reciprocity assumption Trivers (1971) states that players are willing to cooperate if the probability of playing a game again with the same interaction partner exceeds the cost to benefit ratio of the altruistic act. This induces necessary variations in the examination of cooperation in the PD. First, this game also has to be played repeatedly and not only once. Second the payoffs (payoff ratios) matter and should be varied by the experimenter. Third this game has to be played between the same as well as differing interaction partners in groups with $n > 2$, and all players have to be informed about the length of the game. Fourth agents could be given the possibility to gain information and eventually react on observed plays. Especially expanding PD games in form of larger groups or reaction scenarios like punishment or updating beliefs allows evaluating direct reciprocity in sizeable groups.

Public goods games are another way of capturing social (dilemma) situations. Ledyard (1995) provides an overview of the main experimental designs and corresponding findings. PG games are the conventional procedure for the investigation of cooperation strategies with multiple players. The typical PG game consists of 4 players, each having an initial endowment (Gachter and Herrmann, 2006). A self-chosen amount of each players' endowment can be allocated to the provision of a public pool. In the experimental setting all contributions are added and multiplied by a factor strictly larger than one and thereafter equally retransferred to the players. Under certain circumstances PG games can thus be seen as classic PD games especially in the one shot setting (this argument is analogous to the case where indirect and direct reciprocity lead to the same ESS). According to the research design for PG games Ledyard (1995) summarizes major choices for the framework of experiments. As in the PD case this list contains variation in the number of players, payoff or endowment variation, communication possibilities between the different players and variations in the number of played rounds.

The last games that are referred to are ultimatum games (UG). Typical UG (Güth et al., 1982) or dictator games are dyadic games with randomized interaction partners. As already introduced in the previous chapter in the UG setting a donor and a recipient interact. The donor is supposed to share his endowment with a recipient who can only accept or reject the offered sum. In case of rejection both players receive nothing. Economic theory suggests that rational recipients will accept any positive offer such that donors choose to offer a minimum acceptable amount of their endowment (Camerer, 2003). Since UG are played sequentially the recipient always has the possibility to punish a donor by rejection. Ultimatum games and public goods games are the most common experiments for the investigation of indirect reciprocity.

3.2.2 Selected Experimental Results

The findings that will be presented in the following are preselected in a way such that only more recent studies are considered and not the uncountable number of experiments that paved the way for them. The most important finding of experimental economics and behavioral game theory is that many people are by no means selfish rationalists. Even in one-shot games that thwart the possibility of reasoning strategically in the "I scratch your back if you will scratch mine"-way as formalized by Trivers (1971), people do choose to cooperate although economic theory predicts the same agents to be rationality driven defectors or conditional cooperators seeking for future benefits (Fehr and Fischbacher, 2003).

In one-shot PD games around 40% of the players cooperate, although they are instructed about the mode of playing and although learning is possible (Cooper et al., 1996). Comparable results can be found in both PG and UG games. Players in one-shot PG games on average contribute about 50% of their endowments (Fehr and Fischbacher, 2003), while in UG games players offer on average between 42% and 48% (Henrich et al., 2003, Henrich et al., 2005) and reject offers that undercut 25% of the donors endowment (Camerer and Fehr, 2006). Keeping in mind that strategic play is ruled out these numbers are surprising. And although authors run repeated PD games in form of stranger-partner settings (repeated one-shot interaction) and players as a result have the possibility to learn, cooperation rates still remain above 20% (Cooper et al., 1996). From the one-shot interactions especially two types of players have been characterized, strong reciprocators (Rabin, 1993, Gintis, 2000) and self-regarding players.

In iterated games players do behave different. This is most obviously because strategies come into play and far less likely because of learning (Brenner and Vriend, 2006). In nearly all iterated games that are controlled for external influences like communication whether it is a PD or a PG repeated game, cooperation breaks down after some periods (see fig. 5). The only exception may be UG games where the possibility of rejection includes strategic punishment, as I will refer to later. So although there exist strategies that could favor cooperation in the long-run, see for example "Tit-for-Tat" (Axelrod and Hamilton, 1981), these are just not played in reality.

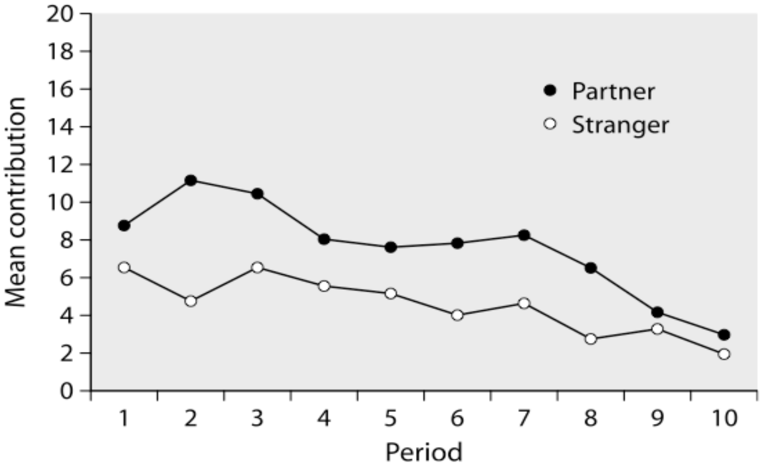

Figure 5: A public good game (4 players, 10 rounds, equal initial endowment) with partner and stranger conditions (Gächter and Herrmann, 2006: 284). Although agents contribute more in the partner setting, cooperation in both conditions is by no means stable.

In the abovementioned repeated PG experiment by Fehr and Gächter (2000) (n=4, 10 periods) the authors apply a stranger and a partner scenario comparable to Cooper *et al.* (1996). When reaching the last periods of the game the repeated one-shot game between strangers and the iterated PG where players stay together in one group both converge towards zero contribution. The reason for failing reciprocity in this setting is supposed to be rooted in simple free-rider problems. Already a small fraction of free-riders who most probably do not contribute just less than others but nothing instead leads to significantly decreased average contributions. Cooperators who have expectations about the other players' choices update their beliefs and decrease their contributions over the course of the game (Fehr and Fischbacher, 2003) (see fig. 6).

But still contribution rates in the partner setting are always strictly above the ones of the stranger setting, a feature that is also valid for repeated stranger-partner scenarios (Cooper et al., 1996). This may induce that "the possibility of behaving strategically strongly increases cooperation" (Gächter and Herrmann, 2006: 282). And behaving strategically in these cases should not be mixed up with rational play approaches of classic game theory. Backwards induction leads to the only Nash equilibrium outcome, namely *always defect* as in the corresponding one-shot games. But this outcome is only reached in the long run. So what these experimental outcomes also induce is that there must be different types of cooperation, namely conditional or unconditional cooperation.

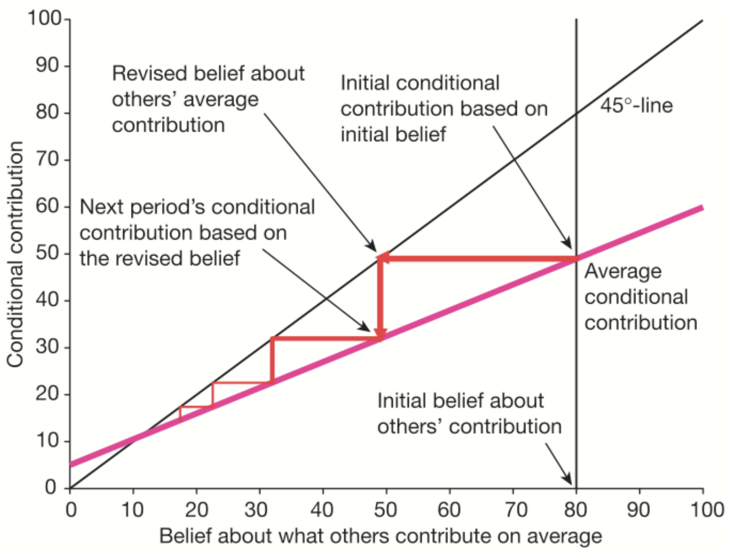

Figure 6: Relationship between contributions and expected contributions of reference agents in a social dilemma situation (PG) (Fehr and Fischbacher, 2003: 787)

Conditional cooperation can be a response by especially two types of players, self-regarding players and strong reciprocators (Camerer and Fehr, 2006, Fehr and Fischbacher, 2003). While self- regarding players choose to defect whenever defection is individually rational, strong reciprocators play pro-social strategies as a response to cooperative outcomes in the previous rounds (Clark and Sefton, 2001). Unconditional cooperative behavior can be observed in one-shot or iterated one-shot PD and PG games (stranger-partner games). It does not rely on other players' strategies or outcomes. Whether this behavior can be characterized as strong reciprocating (Gintis, 2000) or not is still part of contemporary discussions. In a study by Fischbacher, Gächter and Fehr (2001) 50% of the players were conditional cooperators and around 30% were selfish free-riders.

Summarizing at this point, no experiment has yet revealed that direct reciprocity without any supporting mechanism (communication etc.) can lead to stable cooperation rates in groups containing free-riders. Supposed that there are always different types of players (Henrich et al., 2003), self-regarding play always suppresses cooperation (see Figure 3) (Fehr and Gächter, 2002).Reciprocity, whether direct or indirect, has been studied in very different ways more recently (Boyd et al., 2003). The most important feature in those experiments is that players at least have to gain information about other players' decisions, whether they are strangers or known partners. Two experimental designs are striking in this respect, ones' implementing punishment possibilities and others' implementing a player's reputation. These two mechanisms can be seen as 2nd stage mechanisms that can support cooperation in situations where reciprocity would otherwise fail. Coordination games where players may communicate are excluded in the following since this would go far beyond the scope of this chapter.

> "Any mechanism that generates such a belief [a belief that most players will cooperate] has to provide cooperation incentives for the selfish individuals". (Fehr and Fischbacher, 2003: 787)

In the above mentioned repeated partner-stranger PG game as designed by Fehr and Gächter (2000; 2002) players were furthermore given the possibility to punish defectors (free-riders) at the end of each round. In any case punishment was formal and thus caused a payoff reduction for the defector and the punisher. The authors ran different sessions in each condition such that in half of the rounds played, direct punishment was allowed for (see figure 7). What is surprising in this setting is that although punishment is costly for the punisher it in fact occurs and may reach 50% of the initial endowment (Fehr and Schmidt, 2006, Fehr and Gachter, 2002) in both conditions. And since perfect stranger scenarios hinder net benefit seeking through strategic punishment this is even more surprising. If players were self-interested rationalists there should not be any difference in both sessions and free-riding should always drive out cooperation (Fehr and Fischbacher, 2005).

Leaning on Fehr and Gächter (2002) punishment is in consequence rarely used as a strategic instrument for rationality driven players. A second observation that the punishment-endowment ratio is correlated to the magnitude of free-riding (the difference between a defectors and the average contribution) might even underline that strategic play is not the driving force here. Direct reciprocity can thus establish high cooperation rates if punishment is possible (Fehr and Gächter, 2002) and group size remains small (Boyd et al., 2003). The same of course holds for indirect reciprocity as can be seen in the perfect stranger scenario. As for conditional cooperation one can apply the same logic in the characterization of punishment. Some players tend to punish defectors in one-shot interactions, some in repeated interactions and some never punish (Camerer and Fehr, 2006).

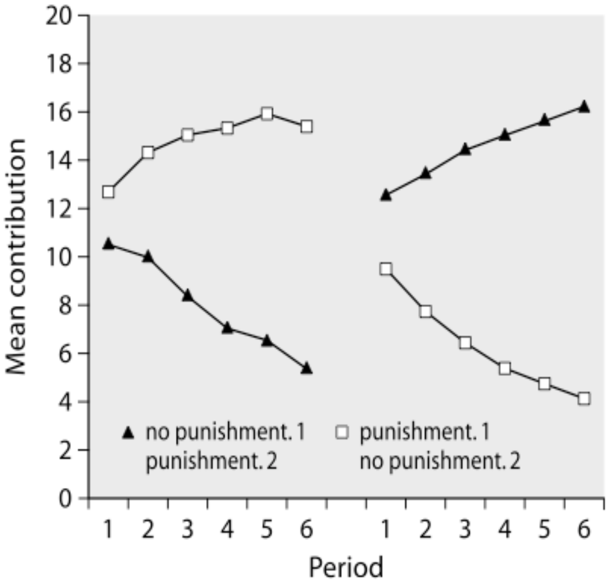

Figure 7: Results of a PG with a perfect stranger setting (2 groups, 4 persons each group, 2 rounds to play). Irrespective if a group starts with punishment possibilities, cooperation breaks down when punishment is not allowed (Fehr and Gächter, 2002; Gächter and Herrmann, 2005: 292).

Concerning strategic play in repeated games, in applying the mechanism of punishment, individuals can thus be seen as conditional punishers that have future benefits in mind (just as it was with conditional cooperators) or on the other hand as strong reciprocators (altruistic punishers) that care about other players' income respectively fairness (Fehr and Gachter, 2002, Boyd et al., 2003). But this does not imply that players who do not punish are always self-regarding. Andreoni and Miller (2002) show that there are players that just never want to decrease other players' payoffs. Those players play cooperatively but never punish altruistically.

Punishment especially indirect punishment as the possibility to penalize even players that failed to directly punish defectors (as introduced in the following) can lead to cooperation in larger groups (up to 500 members) under the rules of direct and indirect reciprocity (Fehr and Fischbacher, 2003).

Simple ultimatum games where the possibility to penalize defectors is inherent to the game provide observations for both punishment motives, and even more.

First, as stated above rejection rates in one-shot as well as in repeated UG are quite high if the offered sum is below 25% of the proposers endowment. Furthermore in extended three players UG with an additional player who can only punish a defector but is otherwise economically independent of the game outcome, 55% choose to punish low offer proposers. And around 70% of the recipients expect such a behavior (Fehr and Fischbacher, 2004). This unveils that players do care about fairness. Second, rejection in repeated UG leads to increases in next rounds' offers at around 7% irrespective of the question if the game is played in stranger or partner scenarios (Fehr and Fischbacher, 2003). Depending on how well recipients anticipate the fact that punishment induces proposers to behave more cooperatively this observation can support both views. But third, and this is more important at this point, the reaction of the proposer reveals that he cares about the recipients reaction. And this is not because of conditional cooperative behavior. Even informal sanctions that do not impinge on anyone's payoff affect proposers decisions in later rounds (Masclet et al., 2003).

What might matter at this point is reputation. As already introduced in the previous section reputation is the other 2nd stage mechanism that can enforce cooperation. In "Evolution of indirect reciprocity by image scoring", Nowak and Sigmund (1998) provide a framework that allows for the evolution of cooperation in sizeable groups where everyone holds a social status in form of a reputation.

Reputation is herein gained via image scoring which means that players are awarded points for every cooperative act and malus points for each defection (see also: Seinen and Schram, 2006). Other players are given information about the scores of reference agents and afterwards choose their play. UG experiments designed to explore indirect reciprocity scenarios reveal two main facts about agents' behavior according to reputation. In perfect stranger experiments players with a good reputation are more likely to be treated cooperatively (Milinski et al., 2002). Cooperation rates in games went up to 90% revealing that at least some of the more selfish players that can be supposed to be part of the game strategically acquire a good reputation (Fehr and Fischbacher, 2003). In addition, experiments that allowed comparing indirect reciprocity games with and without public reputation seeking possibility (of both recipients and donors) revealed that with public recipient reputation, only 37% of donors choose to cooperate when no reputation could be gained, whereas 74% did so in the other scenario. When recipients' reputation was private both numbers decreased to 32% respectively 69% (Engelmann and Fischbacher, 2009). This unveils that altruistic rewarding in indirect reciprocity games is only half the story. The authors conclude that about 80% of all players are prone to strategic incentives and that non-reciprocal (selfish) players finish games with significantly higher payoffs than altruistic players do. Whether indirect reciprocity via reputation as the only enforcement device can therefore lead to evolutionary stable large-scale cooperation is still questionable.

3.3 Social Preferences

As can be seen in the above cited studies agents do behave a lot less selfishly than economic theory assumes. Many people definitively care about other players' payoffs and seem to experience utility gains when equality is established. This is even observable in *Dictator Games,* where strategic play in any way is ruled out (Forsythe et al., 1994). But experiments also revealed that there are many different types of players and that by far not everyone is behaving altruistically.

Most players thus exhibit social preferences suggesting that the self-interest assumption of economic agents is only one side of the medal. The following description is leaned on reviews provided by Fehr and Schmidt (Fehr and Schmidt, 2006) and Fehr and Fischbacher (2005).

One of the most striking preference that has been strongly promoted by a variety of researchers is the preference for *strong reciprocity* (Rabin, 1993, Gintis, 2000, Bowles and Gintis, 2004, Fehr and Henrich, 2003, Bowles and Gintis, 2003). Strong reciprocators are driven by conditionality but do not act strategically and do not consider future payoffs in plays' decisions. Players that exhibit such preferences are supposed to care about fairness. They usually cooperate in one-shot games but only do so in repeated interactions when they face cooperative play. Fairness also induces them to punish defectors. Strong reciprocators thus vary in altruistic rewarding and altruistic punishment even if this behavior ends up with taking a loss (Gintis, 2000; Fehr and Fischbacher, 2005).

A second social preference is *inequity aversion* (Fehr and Schmidt, 1999). Players who are inequity averse cooperate with those that have yielded below-average payoffs so far but punish others that have performed better than others. They furthermore dislike facing unequal income shares (Bolton and Ockenfels, 2000). So just as strong reciprocators they do care about other players outcomes and value them. Inequity may be a form of reputation in this context although a fairly bad one. To see this note that inequity averse players do qualitatively differ from strong reciprocators in their conditionality. Since they do care about average payoffs, decreasing other individuals' outcome is a fundamental motivation. If this includes penalizing strong reciprocators or free-riders makes no difference to them. So although strong reciprocators' and inequity averse players decisions are hard to distinguish in some cases latter ones are by far helping to stabilize cooperative outcomes (Fehr and Fischbacher, 2005; Camerer and Fehr, 2006).

A third main finding is that some players have social preferences in the form of *unconditional altruism*. The most important feature is that those individuals do not ground their play on reciprocity. Unconditional altruists thus never care about other players' payoffs negatively. They only value possible outcome increases and thus another players' economic resources positively (Fehr and Fischbacher, 2005, Fehr and Schmidt, 2006). Consequently they do behave altruistically in the way that they never want to decrease payoffs. But this does not imply that they either reward altruistically or ever punish (Andreoni and Miller, 2002).

The last social preference that shall be referred to at this point corresponds to unconditional altruism in some way. Falk, Fehr and Fischbacher (2005) suggest that some individuals do care about a reference agents' payoff negatively. Players that behave in such a way are believed to have *spiteful* (*envious*) preferences. *Spiteful* persons want to reduce other players' payoffs unconditionally no matter what has been played before or of what sort of (strong reciprocators etc.) they are.

The most important and most probable characteristic can be regarded as the *strong reciprocity* assumption. With regard to pro-social behaviors it can be assumed that most cooperative players exhibit at least this social preference. But as abovementioned experimental results indicate, a large share of players cannot be characterized by social preferences as depicted so far, such that there is still much unexplained heterogeneity. Many players are regarded to be selfish actors that conditionally cooperate to the best of themselves (Engelmann and Fischbacher, 2009).

Players exhibiting pro-social preferences may force others to cooperate, changing the Prisoner's Dilemma into an assurance game (Fehr and Fischbacher, 2003). But on the other side, as experiments show, this need not be the common rule. Depending on the design of the game and possible coordinative mechanisms (punishment, reputation) selfish players may not just dominate players with pro-social preferences but also drive them out in a few periods.

All relevant experiments indicate that it is pro-social preferences that drive cooperation in groups coping with social dilemma situations. Indirect Reciprocity can lead to stable cooperation rates in sizeable groups provided that cooperative players are given mechanisms to suppress selfish reference agents and are willing to do so. Experiments furthermore show that altruistic rewarding and altruistic punishment must be evolutionary independent mechanisms that cannot have common roots. Punishment can thus not be seen as mechanism for the evolution of cooperation (Nowak, 2006). And although reputation has long been recognized as such a mechanism (Nowak and Sigmund, 1998) recent experiments also question this assumption (Engelmann and Fischbacher, 2009).

4. Politics in Hierarchies

> "Nobody argues that the art of navigation is not founded on astronomy, because sailors cannot wait to calculate the Nautical Almanack. Being rational creatures, they go to sea with it ready calculated; and all rational creatures go out upon the sea of life with their minds made up on the common questions of right and wrong, as well as on many of the far more difficult questions of wise and foolish."
> (Mill, J.S., 1861: 31)

We saw in the previous chapter that recent approaches in the investigation of sociality in humans offer new insights into a number of social dilemma situations that have been targeted by numerous studies throughout the last decades. It was underlined that the most prominent assumption towards human cooperative abilities is that they heterogeneously vary between economic agents (Schmidt, 2010).

The *Social Preference* approach as introduced in chapter 3 suggests that individuals may be ultimately characterized according to their decisions in social dilemma situations. Laboratory experiments as described in the previous chapter unveiled that many players behave conditionally cooperative. At least to some extent players can furthermore be seen as having other-regarding preferences (for a discussion of whether to use the term self-regarding instead, see Gintis, 2009). In how far these preferences are based on individually perceived fairness grounds (Gintis, 2000) or even a magnitude of *inequity aversion* that goes far beyond subjective comparison is still part of contemporary research. Although most findings and resulting assumptions about human behavior in the conflict of classic rationality and contemporary approaches dealing with pro-sociality or bounded rationality are striking, important questions remain unanswered. By investigating sociality in humans, throughout the last decade many behavioral traits and strategies supporting cooperation in groups of different size could have been extracted. Especially behaviors shown by *strong reciprocators*, *inequality averse* agents and *unconditional altruists* could (have) play(ed) an important role both in the development of sizeable groups as well as in the maintenance of reciprocity ruling cooperation.

What is remarkable at this point is that as mentioned in section 3.3.2 by no means all players chose to play strategies leading to stable cooperative outcomes in any way. With reference to those players authors just suggest that they must be *envious* or *spiteful* and stop specifying further types afterwards. Up to today there has not been paid much attention towards the possible types of players using anti-social strategies out of an *envious* or *spiteful* motivation to cite only the popular examples. The only remarkable exception can be found in Herrmann, Thoeni and Gächter (2008) where the authors explore anti-social punishment strategies exerted by a significant share of non-cooperative players. So ultimately, the characterization of sociality in humans can be seen as one-sided focusing only on player-types whose strategies support cooperative outcomes in experimental settings. Consequently Fehr and Fischbacher (2005) state that "although previous research clearly indicates that many people exhibit social preferences it is important to keep in mind that not everybody exhibits social preferences. In fact, most studies indicate that there is also a substantial number of people who behave in a purely *selfish* manner".

The following subchapters bring together both, the hypothesis of evolutionary biology about sociality as introduced in section 2 and the findings of experimental economic research about the social preferences of economic agents. For the purpose of simplicity a founded critical investigation of this synthesis will be divided into two parts. In subchapter 4.1 it will be shown that the interpretation of the relevant experimental results of most economic experiments of the last decade need not necessarily be sufficient to deduce universal theories about human cooperative action. Subchapter 4.2 however goes one step further and questions the validity of the applied experimental settings in the search for the patterns of cooperative behavior. Considering the same hypothesis from evolutionary anthropology that build the theoretic framework for the above mentioned economic findings and interpretations both parts will provide a critical assessment within the scope of the reasoning of *social preference* theory. So it is not the purpose of the following subchapters to question the validity of the outcomes of selected experimental research but much more than that to reveal relevant misconceptions and misinterpretations that hinder targeted future research.

4.1 The Situational Character of Preferences

The *social preference* approach is a (logic) tautology: players behave pro-socially and exert social preferences or they just do not. The problems resulting from this assumption are twofold. First of all referring to another work by the same authors in 2005 (Falk et al., 2005), *envious* and/or *spiteful* preferences are stated as being *social preferences*. Without loss of generality one can suppose that at least some *envious* players may be other-regarding just because they are selfish (and vice versa) such that social preferences do not merely refer to pro-social behavior at all. Fehr's and Fischbacher's tautological assumption thus must be neglected.

Second and this is more striking at this point it is not plausible that there are heterogeneous cooperative agents on the one side and homogeneous sociopaths (Gintis, 2009) on the other. In this regard more recent studies offer insights into the variability of agents play. Engelmann and Fischbacher (2009) show that even mainstream experiments might offer much data that just has not been gathered before. By far more players are prone to strategic behavior and conditionality in cooperation or defection than was supposed. And this observation results from a type of game (DG) that is applied as extreme version of ultimatum games in most contemporary experiments, focusing on behavior in social dilemma situations that are ruled by indirect reciprocity. One can assume that the results thus are due to refined measurement tools more than variations in the experimental setting. So the quite different characters of players could have similarly been observed in previous research. Just controlling for a „contamination" of incentives for strategic reputation building (Engelmann and Fischbacher, 2009: 403) offers a magnitude of differentiation in the characterization of players that surpasses the essence of most former studies and questions the categorization of pro-sociality (and resulting social preferences) at least to some extent.

Another point that is relevant here is the "situational character of preferences" (Gintis, 2009: 75). Besides the fact that even in the usual experimental settings of behavioral economics many player types might just have been overlooked according to the variability of their play, many authors question the somewhat path-dependent way of analyzing sociality in laboratory experiments (Binmore, 2007, Gintis, 2009, Camerer, 2003). Of course it is always questionable in how far results of laboratory experiments can be seen as a mirror of real life interactions. Critiques in this regard mostly deal with how incentives for players are chosen, the representativity of samples, or just the chosen games (and limits to the derivation of rules of behavior thereof). The most general critique in this regard can be found in Hammerstein (2003). He hypothesizes that repeated games are not suited well enough for exploring reciprocity or indirect reciprocity in humans, since timescales are too long and task-control mechanisms (e.g. outside options) are usually factored out. I will not refer to most of those points in the following.

The main problem to be noted here instead is whether the subjects are able to adapt their behavior to the situation of the experiment in a way that one can derive real life behavioral strategies from it. Or the other way around, supposed that individuals are able to adapt to the laboratory environment: how does the mode and the aim of experimenting in laboratories affect individuals´ actions and the occurrence of behaviors being triggered through social preferences? And do experimenters really control for a "contamination" of resulting behavior in the laboratory setting?

The supposition that players do in fact adapt behavioral strategies in contexts of analogous studies is substantiated with respect to the comparable experimental results mentioned above.

Considering the first question Gintis (2009) who is dealing with the same matter concludes that it is not behavior but the social preferences itself that are spatiotemporal dependent and thus incongruent:

> "Rather, we suggest that generally a social situation, which we call a *frame*, is imbued with a set of customary social norms that individuals often desire to follow simply because these norms are socially appropriate in the given frame. To the extent that this occurs, preferences themselves, and not just their behavioral implications, are situationally specific. The desire to conform to the moral and conventional standards that people associate with particular social frames thus represents a *meta-preference* that regulates revealed preferences in specific social situations." (Gintis, 2009: 75)

He underlines this assumption in referring to a study by Dana, Cain and Dawes (2006) that offers insights into the supposed dynamics. In this study, participants played a DG with an outside option. Dictators had to choose whether or not to share an endowment of 10$ with a reference agent. After their choice they were given the possibility to take an outside option guaranteeing them on the one side a payoff of 9$ and on the other, that the reference agent would not be informed that a game had been played at all. As mentioned in paragraph 3.2 the usual outcome in a DG is that most donors offer positive amounts to receivers and that the offered sum is strictly below UG transfers, at around 30% of the initial endowment (Camerer, 2003). However in this study about 46% of the donors who decided to transfer a positive amount at first chose the outside option on the cost of 1$ thereafter. Offering a way out of the dilemma resulted in a share of less than 25% of the donors transferring a positive sum to the receivers. This experiment unveils two important findings. First, just as in Engelmann and Fischbacher (2009) palyers' behaviors are far more conditional than most experiments throughout the last decade indicated. Important studies might thus have been "overestimating the level of concern for others' welfare that people have" (Dana Cain and Dawes, 2006) in their extrapolation of the role of social preferences. But as distinct from conditionality in the framework of social preferences altruism in here is proved to be far more dependent on the structure of the interactions showing that preferences must be situation-specific.

Second, most of the experiments aimed at exploring the roots of sociality in humans, seem to be lacking possibilities to capture the interdependencies of *meta-preferences* (Gintis, 2009) in different situational contexts. Players that have been regarded as *strong reciprocators* or inequity averse agents in other experiments now reveal that they in fact are other-regarding in their normative, cooperative behavior but self-regarding if they just have the possibility to "escape"

the framework of interaction. One should therefore reconsider the assumption that displayed behaviors are a proof for a possible ultimate characterization of heterogeneous cooperative agents.

Regarding the question how structure of experiments and the purpose of investigations do change the resulting behaviors of agents, even without thinking of competition between "economic men" (Camerer and Fehr, 2006), one can conclude that the answer must be: severely. So supposed that social preferences must be regarded as a predisposition (Gintis et al., 2005) in agents it is more vague than ever in what circumstances individuals reveal their type and what *frame* induces *meta-preferences* to allow for specific adaptations.

In the line of this thought the second question can be highlighted. The aim of most experiments like the ones mentioned in section 3.3.2 is to reveal the roots of sociality. Mathematical modeling and most laboratory (as well as field) experiments aim at disentangling cooperative traits that are a result of the gene-culture co-evolution to understand "the biological basis for differences in preferences and rationality bounds" (Camerer and Fehr, 2006). But do researchers really control for biases in a way that the biological basis can be understood? Nearly all experiments investigate direct or indirect reciprocity between unrelated humans in experiments where interactions between at most 4 people take place. Since Güth (1982) and the following rise of ultimatum games dyadic and triadic experiments are the rule.

Kin selection as a mechanism for the evolution of cooperation in groups of highly related individuals is never referred to since this focus on the nuclear unit of the family is straightforward and is (correctly) not expected to help in the investigation of large-scale cooperation. But the family is a well-defined structure and a frame in which certain types of other regarding preferences are triggered. And family as the part of a social structure is by definition given in kin selection as an evolutionary stable cooperation rule (see 3.1). This implicit guidance is missing in the other proposed 1st stage mechanisms leaving the problem what structure it is and where it can be located, in which direct or indirect reciprocity reveal other regarding social preferences. So far there have not been many laboratory experiments that targeted this issue. Instead the focus is more and more shifting towards deepening examinations of experimental settings that nearly always offer analogous frames and thus result in path dependent results.

Structure in most UG and all DG experiments must be seen as being highly despotic according to Vehrencamp scale. Power in social dilemma situations is skewed towards a small number of powerful agents. If it is the initial endowment or punishment possibilities that provide agents with power is not important at this point. And as distinct from most recent investigations of efficiency contracts where hierarchies are implicitly part of the game the abovementioned UG and DG experiments not just fail to explore this issue but fail to realize that they have chosen a structure that implements (linear) hierarchies.

Nevertheless the notion of hierarchies as social structures seems to have found its way into contemporary research (Gintis, 2009; Gächter and Herrmann, 2006). "Egalitarian preferences" (Gintis 2009: 70) such as *strong reciprocity* now are seen as a result of the conditions of group living in the EEA that triggered the emergence of an egalitarian ethos (Gächter and Herrmann, 2006). As mentioned in Section 2.3 it is supposed that the gene-culture coevolution (Cavalli-Sforza and Feldman, 1981) gave rise to the emergence and maintenance of pro-social behaviors as well as the establishment of reverse dominance hierarchies in hunter-gatherer societies (Boyd et al., 2003).

It is clear that all individuals do compete for scarce resources with the aim to maximize direct or indirect fitness. In all abovementioned primate species high rates of competition between unrelated individuals can be found. Especially food sharing is quite unusual and competition for receptive females is the rule (Boyd and Silk, 2009). Hierarchies are seen as the organizing principle of all group members' relationships, whether in non-human or human primate groups, resolving and harmonizing competition (De Waal, 1987a).

Agonism in hierarchies thus replaces a significant share of fierce conflicts. In consequence resource access is usually markedly skewed towards the dominant individuals (Sapolsky, 2005). Competition for ranks within the frame of hierarchies in primate societies already is highly political, including alliance formation as well as manipulation (De Waal, 1996).

With respect to structures of human societies, besides the meat sharing hypotheses, especially coalitionary agitation and support are widely supposed to have triggered the emergence of higher egalitarian structures in foraging societies (Strier, 2007). But those structures are quite distinct from the ones that can be observed in primate societies. Although egalitarian hunter-gatherer societies must be seen as being despotic, dominance in here is exerted by peers (moral communities) and aimed at single individuals who impinge against norms (Boehm, 1999). Although this ability to mediate is also supposed to be an important characteristic of alpha males in primate societies, the grounding social structure differs significantly (de Waal, 1996). So in general hierarchies in non-human primate societies show a lot more steepness and linearity in their structure than hierarchies of forager societies do (Boehm, 1999). And the concentration of social power on single individuals like alpha males ore females as a consequence must be seen as a characteristic more suited to non-human primate societies in evolutionary contexts.

On this basis one must argue if the applied experimental designs of most UG and DG games do not resemble hierarchies of primate societies rather than those of forager societies of the upper Pleistocene. It seems odd that researchers derive a human social preference like *strong reciprocity* from behaviors adapted to a structure that humans were especially not used to in the EEA.

So even supposed that the hypothesis that food sharing scenarios as can still be found within the Hadza today are a reason for human cooperative abilities (Hawkes et al., 2001, Kaplan and Gurven, 2005) researchers nevertheless study the situational character of social preferences (Dana et al., 2006) and obviously bias their results due to a lack of control for structure variables that fit to the proposed evolutionary background. If social preferences are situation specific the least thing to control for is the interdependencies between social structure (namely hierarchies) and displayed behaviors before deriving further hypotheses from it.

4.2 Sociality and the Social Structure

> "Why is it that many people seem to have strong social preferences when they interact in small groups, while they seem to be purely self-interested when there is competition?" (Schmidt, 2010: 11)

Considering the development of sociality in human societies it is striking that although on the one hand contemporary western democracies replaced highly despotic hierarchies like kingdoms or chiefdoms, institutional frames of contemporary societies whether it is the company, the church, or nearly all bureaucracies of organizations are quite hierarchical and show in some cases even a pronounced steepness and linearity (e.g. military). Rubin (2002) hypothesizes that this is due to the fact that social structures and especially hierarchies changed significantly with the advent of sedentism. In his view both, the hierarchies of most human and non-human primates as well as the hierarchies of hunter-gatherer societies of the EEA must be seen as consumption hierarchies. He states that the use of this type of social structure is mainly zero sum since all these societies are basically subsistence economies with a "fixed amount of resources, including sometimes access to females" (Rubin, 2000: 262) to be allocated. While it is most commonly agreed that the basic benefit of consumption hierarchies is the reduced individual cost of the struggle for scarce resources the main distinction in both can be found in the increased social ability of humans to form alliances aimed at weakening the very same (de Waal, 1996). Thus consumption hierarchies are regarded to be inherent to the sociality of all group living primates and especially humans, resulting from intragroup competition between fitness maximizing individuals (Rubin, 2002).

With the rise of agriculture and animal domestication at the end of the pleistocene (Diamond, 2002) hierarchies in settled societies changed significantly. Specification, labor division, and especially the ownership of property made trade possible and led to the necessity of markets and hierarchies where former ones were suggested to fail.

So the hierarchies of contemporary societies like the ones in firms or most other organizations are supposed to be "production hierarchies". In the line of Coase (1937) (there is "a cost of using the price mechanism") and later on Williamson (1983; 1985) these hierarchies aim at coordinating economic transactions where massive transaction costs can be expected. Production hierarchies or semi-authoritarian relationships (Coase, 1937) via contracting are thus economically a best response to situations where opportunism and incomplete contracts would otherwise lead to market failures. Within the organization ownership of assets (Grossman and Hart, 1986) on the one hand and as well wage contracts on the other create a power relationship between two contracting economic agents, in the frame of this chapter especially in the employer-employee relationship (Foss et al., 2000). Leaning on Waldron (1998) it is important at this point to make a distinction according to status rankings and formalized positions in organizations. Although both may go hand in hand sometimes in the framework of this work the focus lies on the former structures, calling them production hierarchies in the following.

In line with Boehm's (1999) view on egalitarian societies as reverse dominance hierarchies one can conclude that there has obviously never been a time in which humans did not live in dominance hierarchies and that today humans seem to "have adapted the dominance hierarchy to new uses related to division of labor" (Rubin, 2002: 101). So if dominance behaviors and associated ranks do impinge on increased resource acquisition possibilities, even for today's social structures one can assume that contemporary agents are still prone to acting in this frame. And ranks in firms' hierarchies do significantly impact on the received wages of employees (Gibbons and Waldman, 2006). Since the usual organizational framework offers employees "promotion, salary revision, or bonus" (Prendergast, 1999: 9) as mayor incentives in vertical hierarchies (Rajan and Zingales, 2001), competition for higher ranks must be expected and has been substantiated for such tournament scenarios (Prendergast, 1999, Baker et al., 1994). And obviously the more contestants compete for higher ranks in production hierarchies, the higher the expected wage increase must be. Rajan and Zangales (2001) state that competition between agents varies with the steepness of hierarchies in the institutional setting, showing that it increases in the transition from horizontal hierarchies with less pronounced power relationships to vertical hierarchies.

With reference to the differences between consumption and production hierarchies this is of some importance. De Waal (1996) hypothesizes that egalitarian dominance hierarchies developed from more despotic ones as consequence of humans' dependency on cooperation and the increasing possibilities of leaving societies. For production hierarchies at least in some respect these assumptions can also be applied. Within the firm competition between agents for higher resource provision is skewed towards those groups that show more steepness with more competing agents. Since the principal-agent problem as an authoritarian power-relationship is per se also aimed at surviving in competitive markets, the demand for more egalitarian structures in most firms can be regarded as being quite low. Since hierarchies whether steeper or not are the rule in today's organizations one can suggest that even if labor markets guarantee agents to choose their employee freely there is usually a low incentive to do so on grounds of the structure itself. So despotic production hierarchies may have developed from more egalitarian consumption hierarchies throughout the last 10.000 years out of comparable reasons. As a result for contemporary organizations it can be supposed that there is comparably marked competition crowding out reciprocity. This crowding out then would rather be due to reasons of structure than to reasons of contracts.

If all humans are really innately prepared to engage in dominance-and-submission behaviors (Boehm, 1999) this will most obviously mirror in agents behavior within production hierarchies. Principals rank their agents (Prendergast, 1999). And resourceful agents in consequence must be expected to act correspondingly and "expand their opportunities" (Jensen and Meckling, 1994: 8). This sheds light upon the paradox that while peer effects are expected to increase productivity via team production effects as well as via solving the free-rider problem at least to some extend (Carpenter et al., 2009), social comparisons on the other hand are expected to decrease cooperation where direct reciprocity is the rule (Gächter et al., 2008). Furthermore an evolutionary approach explaining the preferences and related behaviors in social structures may also give hints about the gender differences of behavior in competitive situations (Price, 2008, Andreoni and Vesterlund, 2001). The hypothesis that collective organization increases with the steepness of the authority relation (Williamson, 1985) is therefore only half the story. Leaving the framework of consumption hierarchies aside and entering contemporary structures, competition for resources via ranks in organizations may drive out cooperation significantly. With reference to Schmidt (2009) as well as Camerer and Fehr (2006) asking when and where economic men drive out cooperation one must ask the question if agents should not be expected to exhibit an extreme form of social preferences aimed at increasing the rank in a production hierarchy. Although especially Camerer and Fehr (2006) do offer a solution in terms of strategic incentives, this approach again fails to address the question where (according to the situational character of preferences) agents change their play. If social preferences are spatiotemporally dependent they will certainly differ in production and consumption hierarchies although in both cases individually fitness maximizing behavior is the sole impetus. Recognizing agents as having other regarding preferences for power relationships would thus help sharpening the *social preference* approach and overcome its tautological assumptions. And especially *inequity* *aversion*, which is stated to be a relict from the EEA seems to be an odd social preference in this respect. It is highly probable that this other regarding preference is dependent on the framework in which reciprocity is expected to lead to cooperative outcomes.

While the endowment effect is regarded as the drive of motivation for agents to defend their resources (Gintis, 2009) *inequity aversion* could consequently be seen as the motivation of lower ranked agents to compete for a higher status strategically lowered by one-sided gifts (Jones, 1984)(see fig. 10). High reputation in competitive situations could in this framework also lower the probability of received reciprocal altruism from coalitions of competitors instead of increasing it as it is suggested for consumption hierarchies (Nowak and Sigmund, 1998).

Concluding at this point implementing a rank gradient as social preference could change interpretation of observed behaviors as well as expand the *social preference* approach to competitive situations. If humans have a tendency "to resist being low ranked members of dominance hierarchies" (Rubin, 2002: 100) while at the same time they have a strong tendency to establish exactly the structures that trigger inequality this step should be made and grounding dynamics should be explored.

> "One core question is to understand the workings of competition and the interplay of competition and cooperation in markets, organizations, and politics. Other core questions pertain to understanding the conditions for successful collective actions, the prevailing structure of contracts and property rights, and, above all, the workings of economic incentives, because the workings of incentives constitute the essence of economics. We claim that a satisfactory understanding of these questions is impeded by the self-interest hypothesis." (Fehr and Fischbacher, 2005: 152)

Distinguishing between different types of hierarchies as framing social structure for cooperation may pave the way for the understanding of the interplay between competition and cooperation. In this line of thought the traditional self-interest hypothesis should not be neglected or regarded as hindering a further understanding of agents' preferences but rather be included into the *social preference* approach as postulated throughout the last decade. Gintis (2009), hypothesizing about meta-preferences, offers a way out of this dilemma opening the increasingly path dependent research field for wider approaches mirroring sociality in humans more precisely.

4.3 Concluding remarks

The starting point of a critical assessment of some main results of the research about economic agents` social preferences was to argue whether findings and corresponding interpretations are reasonable or not. It was argued that the transfer of economic reasoning into the framework of evolutionary anthropology obviously brings along a number of problems. Both, the way of applying biologic hypothesis in evaluating laboratory findings as well as the way of designing proper experiments now appear to be focal problems of contemporary research.

From the viewpoint of behavioral economy there is obviously the necessity to examine how suggested player types behave when there is competition. From above mentioned reasons it is more than just doubtful that there are heterogeneous pro-social agents facing self-regarding sociopaths. It is more reasonable that players change their behavior with the transition from consumption to production hierarchies and the increase of interpersonal competition for resources in form of wages. The grounding framework for cooperation that is direct reciprocity rather than indirect reciprocity in most cases needs not to be neglected in here. One can assume that in both structures direct reciprocity can lead to the emergence of stable cooperation rates but that the underlying personal strategies just change and are spatio-temporarily varying.

In hunter-gatherer societies cooperative hunting and resulting food sharing cannot only be explained by other regarding fairness or *inequity averse* preferences. Taking the probability of having success in large game hunting for the Hadza as an example (Marlowe, 2004), one can assume that both hunting as well as meat sharing is aimed at maximizing direct fitness where the probability of marked undersupply is high. Reciprocity here is thus just a best response to the threat of shortage. In the occupational structures of contemporary organizations on the other hand, direct reciprocity is held accountable for the maintenance of teamwork. Will and ability to cooperate are inherently expected from the employees to exploit the efficiency gains provided by team production and are in consequence served by agents if they want to remain in the firm instead of being fired.

But competition, although this is especially not mentioned in the explanations for *inequity aversion* is also inherent to both structures. Gintis (2009) is correct assigning the emergence of other regarding preferences to the exerted pressures on societies in their development in the Pleistocene. But he seriously disregards competition for resources between agents when not taking the main cause for homicide in hunter-gatherer societies into account, namely a competition for females. There is fierce competition in hunter-gatherer societies today, resulting in comparably high homicide rates (Boyd and Silk, 2009). On the other hand, with respect to the tournament game literature of the eighties or more recent behavioral approaches concerning competition in multi-player ultimatum games it is obvious that there is much competition in todays' firms. Moreover if the reasons for pro-sociality are supposed to be rooted in the development of societies throughout the Pleistocene and resulting adaptations in the behavior and social abilities of individuals, this must also hold for competitive abilities or strategies. Social structures in contemporary organizations are all despotic in terms of behavioral ecology varying from those where employees are ranked in steep, linear, and transitive dominance hierarchies (especially in physical-capital intensive industries) to more horizontal ones. Since agents usually do not even own shares of the organization these structures in some respect may even aim at increased competition between agents that care about their social status and corresponding future payoffs (Rajan and Zingales, 2001).

What still remains unexplored is the question about the correct structure for the experimental investigation of the roots of sociality as well as agents' adaptive abilities regarding different social structures. The structures used in most contemporary experiments might be better suited for an investigation of recent hierarchical structures and resulting behavior strategies. Due to the variability of hierarchies that can be found within organizations of western societies it would be important to find out how these structures impact on agents' observed behaviors, and disentangle past results concerning humans and the proposed social preferences.

Research in the field of epidemiology and health economics on the one hand as well as stress research in primate societies on the other reveal that there are significant correlations between rank and health of agents in western societies respectively primate groups. Stress research may be an important approach for the investigation of the social structure contemporary humans are adapted to with respect to their roots of sociality. As will be shown in the upcoming chapters, the notion of the correct structure and resulting rank dynamics is not only a question of research for the foundations sociality but as well a question of stress.

Besides the fact that stress and resulting diseases are suggested to be one mayor epidemic of the 21st century and understanding the roots for it may help battling its causes, the extend to which agents do perceive different structures of games, certain game situations, and other agents behavioral strategies as stressful might be a quantifiable factor in a reliable examination of human sociality and agents social preferences.

Excursus: The Socio Economic Status (SES) - Health Gradient and its Limits

Traditionally the SES must be regarded as “a measure that typically incorporates economic status, measured by income; social status, measured by education; and work status, measured by occupation” (Adler *et al.,* 1994: 15). Profound large-scale examinations of the interdependencies of economic measurements such as income, education and wealth (the SES-health gradient) already started in the nineteen sixties of the 20th century (Marmot and Wilkinson, 1999). Up to today many correlations between the factors of the SES have been revealed especially for western societies. In particular income and income inequality are suggested to be one mayor health indicator on the individual level. Therefore the SES-health gradient is nowadays supposed to be “a multi-level phenomenon. Relationships of variables [such as education, income, and wealth] with health operate through individuals` preferences and their capacities to purchase health inputs, process information, and participate in economic life.”

The focus of more recent approaches has thus increasingly shifted towards disentangling the interdependencies between work status and health. Since research as most prominently done within the Whitehall Studies revealed that income and income inequality in inter-temporal contexts on aggregate societies, should no longer be treated as estimates for the working of the health gradient, the SES as measurement tool for future policy recommendations about health increases today seems to be a quite blunt instrument (Marmot et al., 1978, Marmot et al., 1991, Cutler et al., 2008). Although Operario, Adler and Williams (2004), Singh-Manoux, Marmot and Wilkinson (2005) and others propose a more subjective based measurement of the social status instead of using e.g. absolute income inequality to overcome the above mentioned shortages it will remain questionable to which degree the proposed associations are causal for the correlations (Steptoe and Marmot, 2002, Singh-Manoux et al., 2005) unless the puzzle of the mechanisms underlying the links between rank and health gradient has not been solved. According to Wilkinson (2000) this means that instead of refining the statistic measures of the SES, one should better ask, whether it is not (internal) factors like psychosocial welfare or the social environment that impinge on health and cause diseases.

Debating on the same issue, Deaton (2003) strikes out the importance of the social environment. Referring to findings of evolutionary biology and anthropology he states that health could be particularly dependent on the social structure itself whenever humans are not adapted to it. According to the hypothesis about human sociality during the Pleistocene a significant decrease of health would thus be expected in those hierarchies in which severe inequalities between agents emerge. As can be seen with respect to abovementioned remarks about Rubin`s (2002) distinction of different hierarchies Deaton (2003) implicitly talks about the differences in humans` reception of (Steptoe et al., 2003)consumption and production hierarchies. Wealth or education in consequence would just affect the rank of an individual in the first instance, while the status in contemporary production hierarchies or the competition for it could cause increases in the liability for diseases in employees: "Individuals of greater wealth and education enjoy better health not because of some process affecting the individual in isolation but rather because of the individual`s position in a social hierarchy" (Cutler, Lleras-Muney and Vogl, 2008: 22).

Regarding humans` differences in the reception of their ranks in different hierarchies the path run by Steptoe and Marmot (2002) seems to be fruitful. Their research links stress research findings about agents` affected homeostasis resulting in cardiovascular diseases to SES differences, especially the occupational status. Supposed that it is the rank or the competition for it that affects individuals homeostasis, examining social structures and grounding competitiveness in experimental games via measuring the extend of stress hormone releases of affected agents would offer deep insights into the mechanics of the interdependencies between rank and SES-health gradient. Some research has been done within this frame already (Hasegawa et al., 2008), showing that stress research might be a pathbreaking approach not just in the investigation of occupationally perceived stress, but as well in the investigation of rank-regarding social preferences.

Occupational Ethology

As stated in the previous chapters it is of supreme importance to figure out the mechanics of the transition from cooperation to competition in groups of interacting agents. The possible vertices for an attempt to investigate these mechanics as sketched in chapter 4 and the following excursus proved to be quite diverse. A paper by Wallner, Machatschke and Fieder (2008) takes up some of these accounts proposing a new research field called "Occupational Ethology" (OE). Originally OE is suggested to contribute to the growing body of work-place stress research in doing fundamental experimental examinations about how interactions in different work place scenarios affect each agent's homeostasis. The measurement of affectedness will be conducted via collecting saliva samples of the participants of experiments and the analysis of stress mediators such as cortisol. This gives hints about the degree of a stress reaction resulting from specific interaction situations or just game structures. As an interdisciplinary orientated research field that integrates findings of evolutionary anthropology, social sciences and stress research OE thus especially emphasizes questions of the correct structure underpinning proposed findings instead of just measuring increased cortisol releases as consequence of mere competition (Hasegawa et al., 2008). So according to both its predictive power as well as its value in providing information about the roots of sociality with reference to social structures it is easily more than traditional stress research.

The following subchapters aim at introducing the reader into the fields of applied stress research in humans. Thereafter it will be shown that the assumptions and grounding research questions of OE are in the line with above mentioned reasoning of chapters 2 and 4. This research field can thus be treated as one possible solution to the shortcomings of both, structure as well as related findings of behavioral economic experiments and health economics dealing with the rank gradient and its health affecting consequences.

5.1 Research as proposed by OE

Research as proposed by OE is striking most notably because of its point of departure. As distinct from the usual experimental settings focusing on the maintenance of cooperation occupational ethology starts with the assumption that direct or indirect reciprocity between two reference agents fails. This is exactly the situation, where economic men just tried to drive out cooperation, whether successful or not. As stated above it is neither scientifically reasonable nor inevitably expedient to set out from the point where pro-social cooperators are supposed to establish cooperation in groups that may consist of a significant share of sociopaths. Selection theory assumes that individuals try to increase the probability of having more reproductively successful offspring than its conspecifics. This implies that there is competition for resources between every individual. Altruism or reciprocity must be seen as a strategic adaptation to a competitive situation where cooperation in the long run exceeds the expected benefit to cost ratio of defection. Then cooperation is a best response to failing competition (in the long run) and not the other way around. OE is thus approximating the core mechanisms of the transition from cooperation to competition from the opposite side compared to usual experimental settings.

Applying the same reasoning of evolutionary biology and anthropology as can be found in chapter 2 OE assumes the following propositions to hold for.

It suggests that „all humans faced the same basic system of social ecology and sexual selection“ (Wrangham, 2001: 143) during the Pleistocene. The increase in the need of high energetic food supply as consequence of higher demands due to physiology changes (most of all increasing brain size) forced humans to to adapt quickly to a rapidly changing environment and develop into mobile hunter-gatherer societies. These societies were especially characterized by increasing complexity in developing technologies, a sexual division of labor as well as collective hunting and sharing of large game (Kaplan, Lancaster and Hurtado, 2000). The gene-culture coevolution (Cavalli-Sforza and Feldman, 1981) as proposed, led in consequence to the development of complex societal arrangements in growing societies by humans adapting social behavior strategies. It is highly probable that it was this framework of subsistence economy supported by complex cultural norms and rules that led to the development of reciprocity (Richerson et al., 2003).

Pronounced dominance behaviors in social hierarchies mitigated with the development of the „Man the Social Animal“ (Lewin and Foley, 2004) throughout the EEA reaching a minimum about 10.000 years ago. Still both, hunter-gatherers of the EEA as well as contemporary equivalents had or have structures or consumption hierarchies that must nonetheless be described as being despotic reverse dominance hierarchies (Knauft, 1991;

Boehm, 1999; Boyd and Silk 2007). Contemporary production hierarchies that are a decisive characteristic of large scale societies are suggested to be an invention of modern humans, adopting and advancing consumption hierarchies to the new use of productive efficiency (Rubin, 2002).

Occupational ethology hypothesizes that humans gave rise to a form of competitive social structure that they are not adapted to. Steep and sometimes even transitive hierarchies of contemporary workplaces must be characterized as being highly competitive, forcing agents to contest for scarce resources, particularly wages. Since these are correlated to ranks in formal hierarchies there is certainly also some transition to hierarchy approaches as provided by Coase (1937) or Williamson (1985). Thus, if humans are assumed to exhibit behaviors resulting from the EEA (a notion that is true for nearly all cited research) this further presumption is especially true with respect to situations where reduced resource access will lead to declined darwinian fitness. In respect thereof competition is assumed to be an inherent characteristic of humans having different impacts on males and females that must be seen as acting according to an innate drive for dominance just like the one that can be observed in other primates. Observing that the maintenance of the status quo in dominance hierarchies of most primate societies exhibiting comparably egalitarian dominance styles induces alphas to show a mixture of dominant and reconciliative behaviors instead of suppressing subordinates steadily OE predicts that subordinates expect dominant higher ranking agents to show analogous behaviors. With regard to the suggested *inequity aversion* of agents this is of specific interest (Fehr and Schmidt, 1999). Blurton Jones (1984) hypothesized that large packets of food show diminishing returns to the utility of the proprietor leading to what he called a „tolerated theft“. In this reasoning an owner of a divisible good shares it with a subordinate in order to consolidate his rank. If agents in experiments adapt their behavior to a hierarchical game structure elevating them to a rank above the one of the reference agent, *inequity aversion* as modeled above could be interpreted completely contrary if the social structure changes.

As a highly political animal humans just as the individuals of tolerant or egalitarian primate societies, form coalitions as means of gaining dominance or as means of facing dominant behavior of reference agents. Coalitionary agitation and support is the major force applied and expected by agents facing dominance in competitive interactions (Sapolsky, 2005). OE acknowledges these findings and proposes that coalitionary support is expected by subordinates in hierarchic structures, whenever direct reciprocity between those and a higher ranking reference agents fails. We know today that agents expect third parties to punish cheaters. What is still unsolved is the grounding motivation for sometimes even severe punishment decisions (Fehr and Fischbacher, 2004) by payoff independent third parties and whether the will for coalitionary agitation is adoptable to the motivation to punish in competitive situations.

Finally in the context of failing indirect reciprocity OE suggests that reputation must be defined in a way that it fits to a competitive interaction. Usually reputation is aimed at informing members of a society about past decisions in social dilemma situations. Cooperation leads to increasing reputation, while defection decreases the all in all reputation of agents. Reference agents adjust their game decisions accordingly and cooperate, when they expect the reference agent to cooperate, otherwise they will choose to defect.

In a competitive scenario as it is sketched in the propositions of OE, reputation must work differently. Where independent agents observe repeated defections these are expected to work as a functional variable lowering the reputation of the affected cooperating subordinate. Within the competition in transitive hierarchies this can be seen as a passive strategy to collectively step up the ladder and leave the affected agent behind. After all this last assumption seems to be questionable. If negative reputation is really a trigger for strategic passivity it will be hard to isolate this feature of human competitive behavior in a way that a definition of reputation as proposed by OE is comprehensible.

All these suggested research topics are supposed to vary in both the observed strategic behaviors as well as the stress reaction of the affected cooperator. OE in consequence will explore the dynamics of competition and social reorganization within contemporary hierarchies.

5.1.1 Effects of Stressors on Homeostasis

Stress can be regarded as an evolutionary adaptation optimizing the abilities to deal with a response to environmental and psychosocial situations (McEwen and Seeman, 1999). The stress reaction in an evolutionary context is an adaptive process mobilizing physiologic resources (energy) in order to overcome or challenge life-threatening situations (fight-or-flight response). In contemporary societies one must distinguish between two different types of stressors, namely physical and psychosocial stressors. Former ones are external challenges to homeostasis (e.g. predators). Latter ones must be suggested to result as consequence of individuals anticipation that a threat might occur (e.g. conflict management in social interactions, lack of control) (Sapolsky, 2005).

The physiologic reaction resulting from both kinds of stressors appears to be basically the same, leading to homeostatic imbalance. Two physiological mediators, namely cortisol and catecholamines (adrenalin and noradrenalin) regulate many body processes as well as controlling the reaction to a stressor. Cortisol is the decisive part of OE stress research. Its release as response to a stress reaction mediated by the HPA-axis is described in the following.

1) Neocortical Perception.
2) An extraction of hypothalamic neuropeptides such as corticotropin-releasing hormones (CRH), which triggers the adenohyphophysis to release ACTH (adrenocorticotropic-hormone). ACTH is transported by the blood to the adrenal cortex.
3) Elevated release of the glucorticoid cortisol by the adrenal cortex.
4) The symptoms of an increased cortisol extraction are shown.

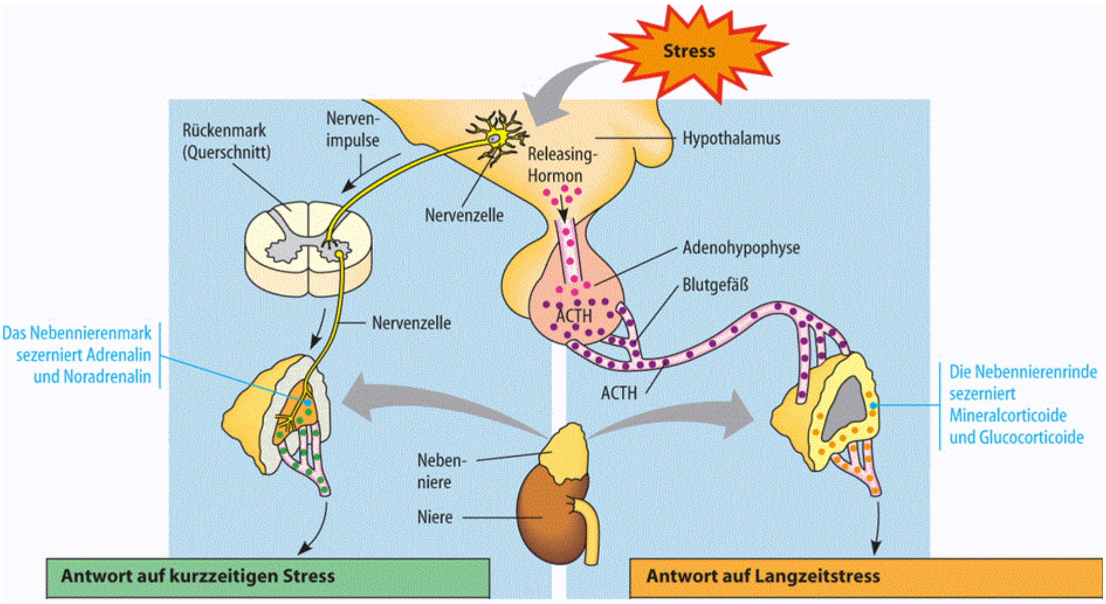

Figure 8: Maintenance of the homeostasis via increased releases of stress mediators in response to short and long term stress (Klinke and Silbernagl, 2005: 463).

In order to maintain the homeostasis, primary functions of cortisol are to increase blood sugar, suppress the immune system and maintain the metabolism of fat and proteins (Klinke et al., 2005).

Cortisol extraction underlies a circadian rhythm. On average cortisol levels peak in the morning and reaches its minimum concentration between midnight and four am.

In connection with an abnormal ACTH level as a reaction of stress, the cortisol level increases. This results in imbalanced homeostasis (see figure 8).

Considering a short term stress reaction in connection with increased levels of catecholamines (autonomous nervous system) the body prepares for a fight-or-flight response: the heart tone increases, relevant muscles are better supplied with energy via blood (glucogenolysis and dilatation of blood vessels), and bronchialdilatation leads to increased oxygen content in the blood. In an evolutionary context this reaction aims at increasing the probability of surviving dilemma situations. But this essential characteristic turns out to be quite harmful if the frequency of stress reactions increases over a certain period. In this case a long term stress reaction leads to prolonged and relatively stable elevated cortisol releases. In consequence the heart rate is elevated, high-density lipoprotein cholesterol is decreased whereas low-density lipoprotein cholesterol is increased, individuals suffer from hypertension, artherosclerotic plaque formation in injured blood vessels and a chronic suppression of the immune system (Sapolsky, 2005). Repeated exposure to stress mediators is thus associated with high mortality rates being grounded in diseases such as cardiovascular disease, morbus cushing, insulin-resistant diabetes or affective disorders (Wallner, Machatschke and Fieder, 2008).

5.2 OE as a Solution to the *Social Preference* Dilemma

The predictions of OE give first hints about the possible contributions to finding a solution for above mentioned dilemmas. OE proposes especially two types of scenarios for experimental settings in which failing direct or indirect reciprocity are suggested to lead to stress in affected cooperators.

> „When direct reciprocity fails between colleagues in the same working unit the predicted stress reaction in the affected cooperator is a function of, (a), the frequency of defections, (b), the social rank distance between the defector and the cooperator, and, (c), the social support from colleagues provided for the affected cooperator. Thus one can predict that the larger the social rank distance between the cooperator (e.g. low SES) and the defector (e.g. high SES) is, the less social support the former will receive, and the higher his stress response will be. In case of failing indirect reciprocity, the stress reaction of the affected cooperator is a

> function of, (a) the frequency of defections and, (b), the degree of negative reputation the cooperator will receive.“ (Wallner, Machatschke and Fieder, 2008: 282)

First of all suggested research questions will lead to a deeper understanding of the grounding mechanisms of occupationally perceived stress in agents with a high probability. It may thus hold the key in bringing forward proofs that ranks impinge on health directly as claimed by Cutler, Lleras-Muney and Vogl (2008). Picking up on at least some of the explored interdependencies in non-human primates between elevated cortisol releases of individuals holding specific ranks and dynamic societal settings of reorganization or stability periods (Sapolsky, 2005), OE assumes that these research questions can be adoptable to humans. With respect to the quite analogous physiology of humans and its nearer relatives this assumption can be expected to hold.

But above this OE can furthermore help in finding a solution to the question when economic agents crowd out cooperation.

Bringing into mind the core arguments about the lacks of investigation of social preferences approaches this is even more striking. The research about other regarding preferences seems to be stuck whenever competition between agents occurs. Up to today there have not been many promising studies trying to close this gap between pro-social and mere rational maximizing behaviors in agents. If OE chooses adoptable research designs it will certainly help disentangling the proposed characteristics of other regarding and selfish players. Gathering informations about how stressed agents are in specific social dilemma situations might give insights about innate preferences for certain social structures and motivations to play cooperatively or respond accurately to received non-cooperative choices to play. Furthermore, knowing about the physiologic effects of rank distances may clarify why peer effects work that different from social comparisons. As mentioned before OE could also explain why agents do have a social preference working against unequal outcomes. It was examined before that it is quite reasonable that especially this preference can be highly situation specific and might have its roots in competitive situations and not in cooperative ones.

6. Conclusions

Questions on the roots of sociality in humans are by no means the domain of biologists anymore. As could be seen during this work economics and evolutionary biology and anthropology are increasingly converging in a number of topics. Throughout the last decades both disciplines increasingly refined the framework of sociality for a deeper understanding cooperation in social animals. It was shown in the beginning of this work that the features of primate sociality have various origins. Natural and sexual selection as well as ecologic pressures shape group structure and group organization in multiple ways. Besides mating systems the social structure itself is the important influence variable on the interplay between conflict and cooperation.

The hierarchy is suggested to be an epiphenomenon of competition replacing a significant share of physical aggression for resources by establishing a concept of dominance and submission. Dominance hierarchies in consequence are one of the most important characteristics of the referred primate species. In primates these dominance hierarchies may take different forms leading to changing patterns of how concentrated social power on certain individuals is. This question of the dominance style lead to a characterization of most referred primate social systems as being relatively despotic. As was further described humans have evolved abilities to cooperate that go far beyond any of those found in other social animals. With the emergence of culture and especially the increased necessity of sharing food, humans have adapted social strategies allowing for evolutionary stable cooperation ruled by reciprocity in groups where the number of unrelated individuals surpasses the number of related ones by far. But humans are also suggested to be quite despotic as well, especially with regard to the last 10.000 years and the emergence of property.

Surprisingly especially behavioral economists seem to underestimate this competitive feature of human sociality. It was summarized in chapter 3 which focusses contemporary research about real life cooperative behaviors in humans chooses. The investigation of human social strategies and characteristics of agents has revealed several important behaviors that might have supported cooperation and resulting outcomes in groups of heterogenous agents. Especially the tendency to punish defectors or gain a reputation in repeated games is noteworthy at this point. Social diversity and the emergence of different types of players such as strong reciprocators or *inequity averse* players are also suggested to have significantly impacted on the emergence and evolutionary stability of cooperation. There are especially two main problems with the experiments and proposed results of behavioral economics and behavioral game theory of the last decade.

First, researchers stated that there are either different types of cooperators or just one type of cheater. The idea stated in this work with reference to Gintis (2009) is that social preferences are situation specific adjusting with every new situation. Taking evolutionary biology into account the idea that diversity leads to heterogenous agents without any exception allowing for homogenous selfish sociopaths seems to be convincing.

Second, although in particular the notion of *strong reciprocity* is convincing there are difficulties with the experimental designs revealing this other regarding preference. Leaning on the description of primate social systems experimental settings in which UG and DG scenarios are applied must be seen as being despotic in their structure in a way that cannot be found in human societies of the EEA but rather in macaque societies. Deriving social preferences from those structures and explaining them with the adaptedness of humans towards social structures of the upper pleistocene seems to be odd in this sense. This is even more striking when looking more precisely at the hypothesized social preference against unequal outcomes.

The idea of *inequity aversion* is that agents value unequal outcomes differently. So although the inequality is the same for both agents, the one having more of a resource suffers less utility losses than his counterpart. Supposed that agents can cope with the situation when facing a steep hierarchic structure and adopt their play the interpretations of all social preferences but *strong reciprocity* must be rethought.

One suggested research field that may be able to cope with the stated problems of contemporary research is occupational ethology (Wallner et al., 2008).

OE`s main target is to explore the reasons for stress related diseases in modern workplaces via measuring cortisol levels of players in different social dilemma situations. The idea behind its research question is that humans experience stress whenever they are not adapted to a certain social structure. So consequently this way of exploring agents when playing games in different game situations and structures may provide deep insights into the situational character of preferences. And furthermore it could allow exploring the motivation and variability behind certain social preferences such as *inequity aversion*.

If one could show that agents consciously act in and adopt their strategies to dominance hierarchies the mechanics of the transition from competition to cooperation and the resulting other regarding preferences could be profoundly assessed and refined.

Glossary

adaptation “A trait that enhances fitness and that arose historically as a result of natural selection for its current role.” (West *et al.*, 2011: 232)

altruism “A behavior that is costly to the actor and beneficial to the recipient or recipients . Costs and benefits are defined on the basis of lifetime direct fitness consequences of a behavior.” (West *et al.*, 2011: 232)

cercopithecine “One of the two major divisions of Old World monkeys, these have cheek pouches.“ (Strier, 2007: 373)

cooperation “A behavior that provides a benefit to another individual (recipient), and the evolution of which has been dependent on its beneficial effect for the recipient.” (West *et al.*, 2011: 232)

direct fitness “The component of fitness gained through the impact of an individual’s behavior on the production of its own offspring; the component of personal fitness due to one’s own behavior.” (West *et al.*, 2011: 232)

dominance “The ability of one individual to intimidate or defeat another individual in a pairwise (dyadic) encounter. In some cases, dominance is assessed from the outcome of aggressive encounters; in other cases, dominance is assessed from the outcome of competitive encounters.” (Boyd and Silk, 2009: A6)

dominance hierarchy “A ranking of individuals in a group that reflects their relative dominance.” (Boyd and Silk, 2009: A6)

fission-fusion “A fluid arrangement whereby social groups break up and rejoin according to the prevailing environmental conditions.” (Barett *et al.*, 2002: 385)

fitness “The number of copies of a particular gene contributed to future generations.” (Barett *et al.*, 2002: 385)

grooming “The process of picking through hair to remove dirt, dead skin, ectoparasites, and other material. Grooming is a common form of affiliative behavior among primates.” (Boyd and Silk, 2009: A8)

hominids “All species that belong to the family Hominidae, which includes *Australopithecus* and *Homo*.” (Barett *et al.*, 2002: 386)

hominoidae A superfamily, “which includes humans, all the living apes, and numerous extinct apelike and humanlike species from the Miocene, Pliocene, and Pleistocene epochs.” (Boyd and Silk, 2009: A8)

inclusive fitness “The effect of one individual’s actions on everybody’s production of offspring, weighted by the relatedness; the sum of direct and indirect fitness.” (West *et al.*, 2011: 232)

indirect fitness “The component of fitness gained from aiding related individuals.” (West *et al.*, 2011: 232)

intersexual selection “A form of sexual selection that is driven by female choice of suitable mating partners.” (Barett *et al.*, 2002: 386)

intrasexual selection “A form of sexual selection driven by competition within the same sex for suitable mating partners. In most cases, intrasexual selection acts more strongly on males than females.“ (Barett *et al.*, 2002: 386)

mating system “The form of courtship, mating, and parenting behavior that characterizes a particular species or population.” (Boyd and Silk, 2009:**(Boyd and Silk, 2009)** (S. A10)

matrilines “Females related to one another through maternal descent“ (Strier, 2007: 377)

mutual benefit “A behavior that is beneficial to both the actor and the recipient.” (West *et al.*, 2011: 232)

natural selection “The process that produces adaptation. Natural selection is based on three postulates: (1) the availability of resources is limited; (2) organisms vary in the ability to survive and reproduce; and (3) traits that influence survival and reproduction are transmitted from parents to offspring. When these three postulates hold, natural selection produces adaptation.” (Boyd and Silk, 2009: A11)

neocortex “Part of the cerebral cortex; generally thought to be most closely associated with problem solving and behavioral flexibility.” (Boyd and Silk, 2009: A11)

patrilines “Males related to one another through paternal descent“ (Strier, 2007: 378)

philopatry “The tendency in some animals to remain in their natal (birth) groups throughout their lives. In many Old World monkey species, females are philopatric.” (Boyd and Silk, 2009: A12)

polyandry “A mating system in which a single female forms a stable pair-bond with two [or more] different males at the same time. Polyandry is generally rare among mammals, but it is thought to occur in some species of marmosets and tamarins.” (Boyd and Silk, 2009: A12)

polygyny “A mating system in which a single male mates with many females. Polygyny is the most common mating system among primate species.” (Boyd and Silk, 2009: A12)

prosimians Lemurs, galagos, lorises, and tarsiers.

recipient “An individual who is affected by the behavior of the focal actor.” (West *et al.*, 2011: 232)

relatedness “A measure of the genetic similarity of two individuals, relative to the average; the least-squares linear regression of the recipient’s genetic breeding value for a trait on the breeding value of the actor.” (West *et al.*, 2011: 232)

sexual dimorphism “Differences between sexually mature males and females in body size or morphology.” (Boyd and Silk, 2009: A14)

sexual selection “Evolution by sexual selection occurs if genetically different individuals differ in their reproductive success because of differences in their ability (1) to compete with others of their own sex for mates or (2) to attract members of the other sex.” (Alcock, 2006: 365)

References

ADLER, N. E., BOYCE, T., CHESNEY, M. A., COHEN, S., FOLKMAN, S., KAHN, R. L. & SYME, S. L. (1994) Socioeconomic Status and Health: The Challange of the Gradient. *American Psychologist,* 49**,** 15-24.

ALCOCK, J. (2006) *Animal Behavior - An Evolutionary Approach,* München, Elsevier.

ALEXANDER, R. D. (1974) The Evolution of Social Behavior. *Annual Review of Ecology and Systematics,* 5**,** 325-383.

ALEXANDER, R. D. (1987) *The Biology of Moral Systems,* New York, Aldine de Gruyter.

ANDREONI, J. & MILLER, J. (2002) Giving according to garp: An experimental test of the consistency of preferences for altruism. *Econometrica,* 70**,** 737-753.

ANDREONI, J. & VESTERLUND, L. (2001) Which is the fair sex? Gender differences in altruism. *Quarterly Journal of Economics,* 116**,** 293-312.

AXELROD, R. (1984) *The Evolution of Cooperation,* New York, Basic Books.

AXELROD, R. & HAMILTON, W. D. (1981) The Evolution of Cooperation. *Science,* 211**,** 1390-1396.

BAKER, G., GIBBS, M. & HOLMSTROM, B. (1994) The Internal Economics of the Firm: Evidence from Personnel Data. *Quarterly Journal of Economics,* 109**,** 881-919.

BARETT, L., DUNBAR, R. & LYCETT, J. (2002) *Human evolutionary psychology,* New York, Palgrave.

BARKOW, J. H., COSMIDES, L. & TOOBY, J. (1992) *The Adapted Mind: Evolutionary Psychology and the Generation of Culture,* New York, Oxford University Press.

BINMORE, K. (2007) *Does Gmae Theors Work? The Bargaining Challenge,* Boston, MIT Press.

BOEHM, C. (1993) Egalitarian Behavior and Reverse Dominance Hierarchy. *Current Anthropology,* 34, 227-254.

BOEHM, C. (1999) *Hierarchy in the Forest: The Evolution of Egalitarian Behavior,* Cambridge (MA), Harvard University Press.

BOLTON, G. E. & OCKENFELS, A. (2000) ERC: A theory of equity, reciprocity, and competition. *American Economic Review,* 90, 166-193.

BOWLES, S. & GINTIS, H. (2003) Origins of human cooperation. IN HAMMERSTEIN, P. (Ed.) *Genetic and Cultural Evolution of Cooperation.* Cambridge, M I T Press.

BOWLES, S. & GINTIS, H. (2004) The evolution of strong reciprocity: cooperation in heterogeneous populations. *Theoretical Population Biology,* 65, 17-28.

BOYD, R., GINTIS, H., BOWLES, S. & RICHERSON, P. J. (2003) The evolution of altruistic punishment. *Proceedings of the National Academy of Sciences of the United States of America,* 100, 3531-3535.

BOYD, R. & RICHERSON, P. J. (1988) The evolution of reciprocity in sizeable groups. *Journal of Theoretical Biology,* 132, 337-356.

BOYD, R. & RICHERSON, P. J. (2009) Culture and the evolution of human cooperation. *Philosophical Transactions of the Royal Society B-Biological Sciences,* 364, 3281-3288.

BOYD, R. & SILK, J. B. (2009) *How Humans Evolved,* New York, W.W. Norton Press.

BRENNER, T. & VRIEND, N. J. (2006) On the behavior of proposers in ultimatum games. *Journal of Economic Behavior & Organization,* 61, 617-631.

BYRNE, R. W. & WHITEN, A. (1988) *Machiavellian intelligence: social expertise and the evolution of intellect in monkeys, apes and humans,* Oxford, Clarendon.

CAMERER, C. F. (2003) *Behavioral Game Theory: Experiments and Strategic Interaction,* Princeton, Princeton University Press.

CAMERER, C. F. & FEHR, E. (2006) When does "economic man" dominate social behavior? *Science,* 311**,** 47-52.

CARMODY, R. N. & WRANGHAM, R. W. (2009) The energetic significance of cooking. *Journal of Human Evolution,* 57**,** 379-391.

CARPENTER, J., BOWLES, S., GINTIS, H. & HWANG, S. H. (2009) Strong reciprocity and team production: Theory and evidence. *Journal of Economic Behavior & Organization,* 71**,** 221-232.

CAVALLI-SFORZA, L. L. & FELDMAN, M. (1981) *Cultural Transmission and Evolution: A Quantitative Approach,* Princeton, Princeton Univesity Press.

CHAPMAN, C. A. & CHAPMAN, L. J. (2000) *Determinants of group size in primates: The importance of travel costs,* Chicago, Univ Chicago Press.

CLARK, K. & SEFTON, M. (2001) The sequential prisoner's dilemma: Evidence on reciprocation. *Economic Journal,* 111**,** 51-68.

CLUTTON-BROCK, T. H. (1974) Primate social organization and ecology. *Nature,* 250**,** 539-542.

CLUTTONBROCK, T. H. & HARVEY, P. H. (1977) Primate ecology and social organization. *Journal of Zoology,* 183**,** 1-39.

COASE, R. H. (1937) The Nature of the Firm. *Economica-New Series,* 4**,** 386-405.

COOPER, R., DEJONG, D. V., FORSYTHE, R. & ROSS, T. W. (1996) Cooperation without reputation: Experimental evidence from prisoner's dilemma games. *Games and Economic Behavior,* 12, 187-218.

COSMIDES, L., BARRETT, H. C. & TOOBY, J. (2010) Adaptive specializations, social exchange, and the evolution of human intelligence. *Proceedings of the National Academy of Sciences of the United States of America,* 107, 9007-9014.

CROCKETT, C. & JANSON, C. H. (2000) Infanticide in res howlers: Female group size, male membership, and a possible link to folivory. IN VAN SCHAIK, C. P. A. J., C.H. (Ed.) *Infanticide by Males and its Implications.* Cambridge, Cambridge University Press.

CUTLER, D. M., LLERAS-MUNEY, A. & VOGL, T. (2008) Socioeconomic Status and Health: Dimensions and Mechanisms. *National Bureau of Economic Research Working Paper Series,* No. 14333.

DANA, J., CAIN, D. M. & DAWES, R. M. (2006) What you don't know won't hurt me: Costly (but quiet) exit in dictator games. *Organizational Behavior and Human Decision Processes,* 100, 193-201.

DAWKINS, R. (1976) *The Selfish Gene,* Oxford, Oxford University Press.

DE WAAL, F. B. M. (1987a) Dynamics of social relationships. IN SMUTS, B. B., CHENEY, D.L., SEYFARTH, R.M., WRANGHAM, R.W., STRUHSACKER, T.T. (Ed.) *Primate Societies.* Chicago, Chicago University Press.

DE WAAL, F. B. M. (1987b) Tension regulation and nonreproductive functions of sex in captive bonobos. *National Geographic Research,* 3, 318-335.

DE WAAL, F. B. M. (1995) Bonobo sex and society. *Scientific American,* 272, 82-88.

DE WAAL, F. B. M. (1996) *Good Natured: The Origins of Right and Wrong in Humans and other Animals,* Cambridge, Harvard University Press.

DE WAAL, F. B. M. (2001) Apes from Venus: Bonobos and Human Social Evolution. IN DE WAAL, F. B. M. (Ed.) *Tree of Origin: What Primate Behavior Can Tell Us about Human Social Evolution.* Cambridge, Harvard University Press.

DE WAAL, F. B. M. & BROSNAN, S. F. (2006) *Simple and complex reciprocity in primates*, Springer-Verlag Berlin.

DE WAAL, F. B. M. & LUTTRELL, L. M. (1989) Toward a comparative socioecology of the genus Macaqa: different dominance styles in rhesus and stumptail monkeys. *American Journal of Primatology,* 19**,** 83-110.

DEATON, A. (2003) Health, inequality, and economic development. *Journal of Economic Literature,* 41**,** 113-158.

DIAMOND, J. (2002) Evolution, consequences and future of plant and animal domestication. *Nature,* 418**,** 700-707.

DITTUS, W. P. J. (1979) The evolution of behaviors regulating densitiy and age-specific sex-ratios in a primate population. *Behaviour,* 69**,** 265-301.

DUNBAR, R. I. M. (1988) *Primate Social Systems,* Ithaka, Cornell University Press.

DUNBAR, R. I. M. (1992) Neocortex size as a constraint on group-size in primates. *Journal of Human Evolution,* 22**,** 469-493.

DUNBAR, R. I. M. (1998) The social brain hypothesis. *Evolutionary Anthropology,* 6**,** 178-190.

DUNBAR, R. I. M. (2001) Brains on Two Legs: Group Size and the Evolution of Intelligence. IN DE WAAL, F. B. M. (Ed.) *Tree of Origin: What Primate Behavior Can Tell Us about Human Social Evolution.* Cambridge, Harvard University Press.

EIBL-EIBESFELDT, I. (1979) *The Biology of Peace and War: Men, Animals, and Aggression,* New York, Viking.

EISENBERG, J. F., RUDRAN, R. & MUCKENHI, N. A. (1972) Relation between ecology and social structure in primates. *Science,* 176**,** 863-874.

ENGELMANN, D. & FISCHBACHER, U. (2009) Indirect reciprocity and strategic reputation building in an experimental helping game. *Games and Economic Behavior,* 67**,** 399-407.

EVANS-PRITCHARD, E. E. (1940) *The Nuer: A description of the modes of livelihood and political institutions of a nilotic people,* Oxford, Clarendon.

FALK, A., FEHR, E. & FISCHBACHER, U. (2005) Driving forces behind informal sanctions. *Econometrica,* 73**,** 2017-2030.

FEHR, E. & FISCHBACHER, U. (2003) The nature of human altruism. *Nature,* 425**,** 785-791.

FEHR, E. & FISCHBACHER, U. (2004) Third-party punishment and social norms. *Evolution and Human Behavior,* 25**,** 63-87.

FEHR, E. & FISCHBACHER, U. (2005) The economics of strong reciprocity. IN GINTIS, H., BOWLES, S., BOYD, R. & FEHR, E. (Eds.) *Moral sentiments and material interests: the foundations of cooperation in economic life.* Cambridge, MIT Press.

FEHR, E. & GACHTER, S. (2000) Cooperation and punishment in public goods experiments. *American Economic Review,* 90**,** 980-994.

FEHR, E. & GACHTER, S. (2002) Altruistic punishment in humans. *Nature,* 415**,** 137-140.

FEHR, E. & HENRICH, J. (2003) Is strong reciprocity a maladaptation? On the evolutionary foundations of human altruism. IN HAMMERSTEIN, P. (Ed.) *Genetic and Cultural Evolution of Cooperation.* Cambridge, M I T Press.

FEHR, E. & SCHMIDT, K. M. (1999) A theory of fairness, competition, and cooperation. *Quarterly Journal of Economics,* 114**,** 817-868.

FEHR, E. & SCHMIDT, M. (2006) The Economics of Fairness, Reciprocity and Altruism – Experimental Evidence and New Theories. IN KOLM, S. & YTHIER, J. M. (Eds.) *In Handbook on the Economics of Giving, Recipcrocity and Altruism.* Amsterdam, Elsevier.

FISCHBACHER, U., GACHTER, S. & FEHR, E. (2001) Are people conditionally cooperative? Evidence from a public goods experiment. *Economics Letters,* 71**,** 397-404.

FLACK, J. C. & DE WAAL, F. B. M. (2004) Dominance style, social power, and conflict management. IN THIERRY, B., SINGH, M. & KAUMANNS, W. (Eds.) *Macaque societies: A model for the study of social organization.* Cambridge, Cambridge University Press.

FOLEY, R. & LAHR, M. M. (2003) On stony ground: Lithic technology, human evolution, and the emergence of culture. *Evolutionary Anthropology,* 12**,** 109-122.

FORSYTHE, R., HOROWITZ, J. L., SAVIN, N. E. & SEFTON, M. (1994) Fairness in simple bargaining experiments. *Games and Economic Behavior,* 6**,** 347-369.

FOSS, N., LANDO, H. & THOMSEN, S. (2000) The Theory of the Firm. IN BOUCKAERT, B. & DE GEEST, G. (Eds.) *Encyclopedia of Law and Economics, Volume 1: The History and Methodology of Law and Economics.* Cheltenham, Edward Elgar.

GACHTER, S. & HERRMANN, B. (2006) *Human cooperation from an economic perspective*, Springer-Verlag Berlin.

GÄCHTER, S., NOSENZO, D. & SEFTON, M. (2008) The Impact of Social Comparisons on Reciprocity. *IZA Discussion Paper.* Bonn, Institute for the Future of Labor.

GIBBONS, R. & WALDMAN, M. (2006) Enriching a theory of wage and promotion dynamics inside firms. *Journal of Labor Economics,* 24**,** 59-107.

GIBBS, R. A., ROGERS, J., KATZE, M. G., BUMGARNER, R., WEINSTOCK, G. M., MARDIS, E. R., REMINGTON, K. A., STRAUSBERG, R. L., VENTER, J. C., WILSON, R. K., BATZER, M. A., BUSTAMANTE, C. D., EICHLER, E. E., HAHN, M. W., HARDISON, R. C., MAKOVA, K. D., MILLER, W., MILOSAVLJEVIC, A., PALERMO, R. E., SIEPEL, A., SIKELA, J. M., ATTAWAY, T., BELL, S., BERNARD, K. E., BUHAY, C. J., CHANDRABOSE, M. N., DAO, M., DAVIS, C., DELEHAUNTY, K. D., DING, Y., DINH, H. H., DUGAN-ROCHA, S., FULTON, L. A., GABISI, R. A., GARNER, T. T., GODFREY, J., HAWES, A. C., HERNANDEZ, J., HINES, S., HOLDER, M., HUME, J., JHANGIANI, S. N., JOSHI, V., KHAN, Z. M., KIRKNESS, E. F., CREE, A., FOWLER, R. G., LEE, S., LEWIS, L. R., LI, Z. W., LIU, Y. S., MOORE, S. M., MUZNY, D., NAZARETH, L. V., NGO, D. N., OKWUONU, G. O., PAI, G., PARKER, D., PAUL, H. A., PFANNKOCH, C., POHL, C. S., ROGERS, Y. H., RUIZ, S. J., SABO, A., SANTIBANEZ, J., SCHNEIDER, B. W., SMITH, S. M., SODERGREN, E., SVATEK, A. F., UTTERBACK, T. R., VATTATHIL, S., WARREN, W., WHITE, C. S., CHINWALLA, A. T., FENG, Y., HALPERN, A. L., HILLIER, L. W., HUANG, X. Q., MINX, P., NELSON, J. O., PEPIN, K. H., QIN, X., SUTTON, G. G., VENTER, E., WALENZ, B. P., WALLIS, J. W., WORLEY, K. C., YANG, S. P., JONES, S. M., MARRA, M. A., ROCCHI, M., SCHEIN, J. E., BAERTSCH, R., CLARKE, L., CSUROS, M., GLASSCOCK, J., HARRIS, R. A., HAVIAK, P., JACKSON, A. R., JIANG, H. Y., et al. (2007) Evolutionary and biomedical insights from the rhesus macaque genome. *Science,* 316**,** 222-234.

GIGERENZER, G. & SELTEN, R. (2001) Rethinking rationality. IN GIGERENZER, G. & SELTEN, R. (Ed.) *Bounded rationality: The adaptive toolbox*. Cambridge, MIT Press

GINTIS, H. (2000) Strong reciprocity and human sociality. *Journal of Theoretical Biology,* 206, 169-179.

GINTIS, H. (2009) *The Bounds of Reason: Game Theory and the Unification of the Behavioral Sciences,* Princeton, Princeton University Press.

GINTIS, H., BOWLES, S., BOYD, R. & FEHR, E. (2005) Moral Sentiments ans Material Interests: Origin, Evidence, and Consequences. IN GINTIS, H., BOWLES, S., BOYD, R. & FEHR, E. (Eds.) *Moral Sentiments and Material Interests.* Cambridge, MIT Press.

GROSSMAN, S. J. & HART, O. D. (1986) The Costs and Benefits of Ownership: A Theory of Vertical and Lateral Integration. *Journal of Political Economy,* 94, 691-719.

GÜTH, W., SCHMITTBERGER, R. & SCHWARZE, B. (1982) An experimental analysis of ultimatum bargaining. *Journal of Economic Behavior & Organization,* 3, 367-388.

HAMILTON, W. D. (1964) Genetical evolution of social behavior. *Journal of Theoretical Biology,* 7, 1-16.

HAMMERSTEIN, P. (2003) Why is reciprocity so rare in social animals? A protestant appeal. IN HAMMERSTEIN, P. (Ed.) *Genetic and Cultural Evolution of Cooperation.* Cambridge, MIT Press.

HARCOURT, A. H. (1987) Dominance and fertility among female primates. *Journal of Zoology,* 213, 471-487.

HASEGAWA, M., TODA, M. & MORIMOTO, K. (2008) Changes in salivary physiological stress markers associated with winning and losing. *Biomedical Research-Tokyo,* 29, 43-46.

HAUSFATER, G. (1975) Dominance and reproduction in Baboons (Papio-cynocephalus). *Contributions to Primatology,* 7, 2-150.

HAWKES, K., O'CONNELL, J. F. & JONES, N. G. B. (2001) Hadza meat sharing. *Evolution and Human Behavior,* 22**,** 113-142.

HENRICH, J., BOYD, R., BOWLES, S., CAMERER, C., FEHR, E. & GINTIS, H. (2003) *Foundations of Human Sociality: Ethnography and Experiments in Fifteen Small-scale Societies,* Oxford, Oxford University Press.

HENRICH, J., BOYD, R., BOWLES, S., CAMERER, C., FEHR, E., GINTIS, H. & MCELREATH, R. (2001) Cooperation, Reciprocity and Punishment in Fifteen Small-scale Societies. *American Economic Review,* 91**,** 73– 78.

HENRICH, J., BOYD, R., BOWLES, S., CAMERER, C., FEHR, E., GINTIS, H., MCELREATH, R., ALVARD, M., BARR, A., ENSMINGER, J., HENRICH, N. S., HILL, K., GIL-WHITE, F., GURVEN, M., MARLOWE, F. W., PATTON, J. Q. & TRACER, D. (2005) "Economic man" in cross-cultural perspective: Behavioral experiments in 15 small-scale societies. *Behavioral and Brain Sciences,* 28**,** 795-815.

HERRMANN, B., THONI, C. & GACHTER, S. (2008) Antisocial punishment across societies. *Science,* 319**,** 1362-1367.

HRDY, S. B. (1974) Male-male competition and infanticide among Langurs (Presbytis-entellus) of Abu, Rajasthan. *Folia Primatologica,* 22**,** 19-58.

ISBELL, L. A. (1991) Contest and scramble competition: patterns of female aggression and ranging behavior among primates. *Behavioral Ecology,* 2**,** 143-155.

JANSON, C. H. (1992) Evolutionary Ecology of Primate Social Structure. IN WINTERTHALER, E. A. S. B. (Ed.) *Evolutionary Ecology and Human Behavior.* New York, Aldine de Gruyter.

JENSEN, M. C. & MECKLING, W. H. (1994) The Nature of Man. *Journal of Applied Corporate Finance,* 7**,** 4-19.

JONES, N. G. B. (1984) A selfish origin for human food sharing: tolerated theft. *Ethology and Sociobiology,* 5**,** 1-3.

KAHNEMANN, D., SLOVIC, P., & TVERSKY, A. (1982) *Judgement under uncertainty: Heuristics and biases*, New York, Cambridge University Press

KAPLAN, H. & GURVEN, M. (2005) The Natural History of Human Food Sharing and Cooperation: A Review and a New Multi-Individual Approach to the Negotiation of Norms. IN GINTIS, H., BOWLES, S., BOYD, R. & FEHR, E. (Eds.) *Moral sentiments and material interests: the foundations of cooperation in economic life.* Cambridge, MIT Press.

KAPLAN, H., HILL, K., LANCASTER, J. & HURTADO, A. M. (2000) A theory of human life history evolution: Diet, intelligence, and longevity. *Evolutionary Anthropology,* 9**,** 156-185.

KAPPELER, P. M. & VAN SCHAIK, C. P. (2002) Evolution of primate social systems. *International Journal of Primatology,* 23**,** 707-740.

KINZEY, W. G. (1987) *The Evolution of Human Behavior: Primate Models,* Albany, SUNY Press.

KLINKE, R., PAPE, H. C. & SILBERNAGL, S. (2005) *Physiologie,* Stuttgart, New York, Thieme.

KNAUFT, B. M. (1991) Violence and sociality in human evolution. *Current Anthropology,* 32**,** 391-428.

KUDO, H. & DUNBAR, R. I. M. (2001) Neocortex size and social network size in primates. *Animal Behaviour,* 62**,** 711-722.

LAHR, M. M. & FOLEY, R. A. (1998) Towards a theory of modern human origins: Geography, demography, and diversity in recent human evolution. *Yearbook of Physical Anthropology, Vol 41 - 1998.* New York, Wiley-Liss, Inc.

LEDYARD, J. (1995) Public Goods: A Survey of Experimental Research. IN KAGEL, J. H., AND ROTH, A.E. (Ed.) *Handbook of Experimental Economics.* Princeton, Princeton University Press.

LEE, P. C. (1996) The meanings of weaning: Growth, lactation, and life history. *Evolutionary Anthropology,* 5**,** 87-96.

LEIMAR, O. & HAMMERSTEIN, P. (2001) Evolution of cooperation through indirect reciprocity. *Proceedings of the Royal Society of London Series B-Biological Sciences,* 268**,** 745-753.

LEWIN, R. & FOLEY, A. (2004) *Principles of Human Evolution,* Oxford, Blackwell.

LIEBERMAN, E., HAUERT, C. & NOWAK, M. A. (2005) Evolutionary dynamics on graphs. *Nature,* 433**,** 312-316.

MARLOWE, F. W. (2004) What explains hadza food sharing? IN ALVARD, M. S. (Ed.) *Socioeconomic Aspects of Human Behavioral Ecology.* Amsterdam, Jai-Elsevier Sci Bv.

MARMOT, M. & WILKINSON, R. G. (1999) *Social Determinants of Health,* Oxford, Oxford University Press.

MARMOT, M. G., ROSE, G., SHIPLEY, M. & HAMILTON, P. J. S. (1978) Employment Grade and Coronary Heart Disease in British Civil-Servants. *Journal of Epidemiology and Community Health,* 32**,** 244-249.

MARMOT, M. G., SMITH, G. D., STANSFELD, S., PATEL, C., NORTH, F., HEAD, J., WHITE, I., BRUNNER, E. & FEENEY, A. (1991) Health Inequalities Among British Civil-Servants: The Whitehall-II Study. *Lancet,* 337**,** 1387-1393.

MASCLET, D., NOUSSAIR, C., TUCKER, S. & VILLEVAL, M. C. (2003) Monetary and nonmonetary punishment in the voluntary contributions mechanism. *American Economic Review,* 93**,** 366-380.

MATSUMURA, S. (1999) The evolution of "egalitarian" and "despotic" social systems among macaques. *Primates,* 40**,** 23-31.

MCEWEN, B. S. & SEEMAN, T. (1999) Protective and damaging effects of mediators of stress - Elaborating and testing the concepts of allostasis and allostatic load. IN ADLER, N. E., MARMOT, M., MCEWEN, B. & STEWART, J. (Eds.) *Socioeconomic Status and Health in Industrial Nations - Social, Psychological, and Biological Pathways.* New York, New York Acad Sciences.

MILINSKI, M., SEMMANN, D. & KRAMBECK, H. J. (2002) Donors to charity gain in both indirect reciprocity and political reputation. *Proceedings of the Royal Society of London Series B-Biological Sciences,* 269**,** 881-883.

MITANI, J. C., GROSLOUIS, J. & RICHARDS, A. F. (1996) Sexual dimorphism, the operational sex ratio, and the intensity of male competition in polygynous primates. *American Naturalist,* 147**,** 966-980.

MULLER, M. N. (2002) *Agonistic relations among Kanyawara chimpanzees,* New York, Cambridge Univ Press.

NISHIDA, T. & HIRAIWA-HASAGEWA, M. (1987) Chimpanzees and bonobos: Cooperative relationships among males. IN SMUTS, B. B., CHENEY, D. L., SEYFARTH, R. M., WRANGHAM, R. W. & STRUHSACKER, T. T. (Eds.) *Primate Societies.* Chicago, University of Chicago Press.

NOE, R. & HAMMERSTEIN, P. (1995) Biological markets. *Trends in Ecology & Evolution,* 10**,** 336-339.

NOWAK, M. A. (2006) Five rules for the evolution of cooperation. *Science,* 314**,** 1560-1563.

NOWAK, M. A. & SIGMUND, K. (1998) Evolution of indirect reciprocity by image scoring. *Nature,* 393, 573-577.

NOWAK, M. A. & SIGMUND, K. (2005) Evolution of indirect reciprocity. *Nature,* 437, 1291-1298.

OHTSUKI, H. & IWASA, Y. (2004) How should we define goodness? Reputation dynamics in indirect reciprocity. *Journal of Theoretical Biology,* 231, 107-120.

OPERARIO, D., ADLER, N. E. & WILLIAMS, D. R. (2004) Subjective social status: Reliability and predictive utility for global health. *Psychology & Health,* 19, 237-246.

OSTROM, E. (2005) Policies That Crowd Out Reciprocity and Collective Action. IN GINTIS, H., BOWLES, S., BOYD, R. & FEHR, E. (Eds.) *Moral sentiments and material interests: the foundations of cooperation in economic life.* Cambridge, MIT Press.

PACKER, C. & PUSEY, A. E. (1979) Female aggression ans male membership in troops of japanese macaques and olive baboons. *Folia Primatologica,* 31, 212-218.

PRENDERGAST, C. (1999) The provision of incentives in firms. *Journal of Economic Literature,* 37, 7-63.

PRICE, J. (2008) Gender differences in the response to competition. *Industrial & Labor Relations Review,* 61, 320-333.

PUSEY, A., WILLIAMS, J. & GOODALL, J. (1997) The influence of dominance rank on the reproductive success of female chimpanzees. *Science,* 277, 828-831.

PUSEY, A. E. & PACKER, C. (1987) Dispersal and Philopatry. IN SMUTS, B. B., CHENEY, D. L., SEYFARTH, R. M., WRANGHAM, R. W. & STRUHSACKER, T. T. (Eds.) *Primate Societies.* Chicago, University of Chicago Press.

RABIN, M. (1993) Iincorporating fairness into game-theory and economics. *American Economic Review,* 83**,** 1281-1302.

RAJAN, R. G. & ZINGALES, L. (2001) The firm as a dedicated hierarchy: A theory of the origins and growth of firms. *Quarterly Journal of Economics,* 116**,** 805-851.

RICHERSON, P. J., BOYD, R. T. & HENRICH, J. (2003) Cultural evolution of human cooperation. IN HAMMERSTEIN, P. (Ed.) *Genetic and Cultural Evolution of Cooperation.* Cambridge, MIT Press.

RUBIN, P. (2002) *Darwinian Politics: The Evolutionary Origins of Freedom,* New Brunswick, Rutgers University Press.

RUBIN, P. H. (2000) Hierarchy. *Human Nature-an Interdisciplinary Biosocial Perspective,* 11**,** 259-279.

SAPOLSKY, R. M. (2004) Social status and health in humans and other animals. *Annual Review of Anthropology,* 33**,** 393-418.

SAPOLSKY, R. M. (2005) The influence of social hierarchy on primate health. *Science,* 308**,** 648-652.

SCHMIDT, K. M. (2010) Social Preferences and Competition. *University of Munich Discussion Paper in Economics.* Munich, University of Munich.

SCHULZE, W. S., LUBATKIN, M. H. & DINO, R. N. (2003) Toward a theory of agency and altruism in family firms. *Journal of Business Venturing,* 18**,** 473-490.

SEINEN, I. & SCHRAM, A. (2006) Social status and group norms: Indirect reciprocity in a repeated helping experiment. *European Economic Review,* 50**,** 581-602.

SELTEN, R. (2001) What is bounded rationality? IN GIGERENZER, G. & SELTEN, R. (Ed.) *Bounded rationality: The adaptive toolbox*. Cambridge, MIT Press

SEYFARTH, R. M. (1977) Model of social grooming among adult female monkeys. *Journal of Theoretical Biology,* 65**,** 671-698.

SILK, J. B. (2001) Ties that bond: the role of kinship in primate societies. IN STONE, L. (Ed.) *New Directions in Anthropological Kinship.* Boulder, Rowman and Littlefield.

SILK, J. B. (2006) *Practicing Hamilton's rule: kin selection in primate groups,* Berlin, Springer-Verlag.

SILK, J. B. (2007) Social components of fitness in primate groups. *Science,* 317**,** 1347-1351.

SILK, J. B., ALBERTS, S. C. & ALTMANN, J. (2003) Social bonds of female baboons enhance infant survival. *Science,* 302**,** 1231-1234.

SIMON, H.A. (1955) A behavioral model of rational choice. *Quarterly Journal of Economics*, 69, 99-118

SINGH-MANOUX, A., MARMOT, M. G. & ADLER, N. E. (2005) Does subjective social status predict health and change in health status better than objective status? *Psychosomatic Medicine,* 67**,** 855-861.

SMUTS, B. B. (1985) *Sex and Friendship in Baboons,* New York, Aldine.

SMUTS, B. B. & SMUTS, R. W. (1993) Male-aggression and sexual coercion of females in non-human primates and other mammals -evidence and theoretical implications. *Advances in the Study of Behavior, Vol 22.* San Diego, Academic Press Inc.

STEPTOE, A., KUNZ-EBRECHT, S., OWEN, N., FELDMAN, P. J., WILLEMSEN, G., KIRSCHBAUM, C. & MARMOT, M. (2003) Socioeconomic status and stress-related biological responses over the working day. *Psychosomatic Medicine,* 65**,** 461-470.

STEPTOE, A. & MARMOT, M. (2002) The role of psychobiological pathways in socio-economic inequalities in cardiovascular disease risk. *European Heart Journal,* 23, 13-25.

STEWART, K. J. & HARCOURT, A. H. (1987) Gorillas: Variation in female relationships. IN SMUTS, B. B., CHENEY, D. L., SEYFARTH, R. M., WRANGHAM, R. W. & STRUHSACKER, T. T. (Eds.) *Primate Societies.* Chicago, Chicago University Press.

STRIER, K. B. (2007) *Primate Behavioral Ecology,* Boston, Allyn & Bacon.

STRIER, K. B., BOUBLI, J. R., POSSAMAI, C. B. & MENDES, S. L. (2006) Population demography of northern muriquis (Brachyteles hypoxanthus) at the Estacao Biologica de Caratinga/Reserva Particular do Patrimonio Natural-Feliciano Miguel Abdala, Minas Gerais, Brazil. *American Journal of Physical Anthropology,* 130, 227-237.

STRUHSACKER, T. T. A. L., L. (1987) Colobines: infanticide by adult males. IN SMUTS, B. B., CHENEY, D. L., SEYFARTH, R. M., WRANGHAM, R. W. & STRUHSACKER, T. T. (Eds.) *Primate Societies.* Chicago, University of Chicago Press.

STUMPF, R. M. (2007) Chimpanzees and Bonobos. IN CAMPBELL, C. J., FUENTES, A., MACKINNON, K. C., PANGER, M. & BEARDER, S. K. (Eds.) *Primates in Perspective.* New York, Oxford University Press.

TRIVERS, R. L. (1971) Evolution of reciprocal altruism. *Quarterly Review of Biology,* 46, 35-57.

TRIVERS, R. L. (1972) Parental investment and sexual selection. IN CAMPBELL, B. (Ed.) *Sexual Selection and the Descent of Man 1871-1971.* Chicago, Aldine.

VAN SCHAIK, C. P. (1983) Why are diurnial primates living in groups. *Behaviour,* 87, 120-144.

VAN SCHAIK, C. P. & VAN NOORDWIJK, M. A. (1985) Evolutionary Effect of the Absence of Felids on the Social Organization of the Macaques on the Island of Simeulue. *Folia Primatologica,* 44**,** 138-147.

VAN SCHAIK, C. P. & VAN NOORDWIJK, M. A. (1988) Scramble and contest in feeding competition among female long-tailed macaques (Macaqa fascicularis). *Behaviour,* 105**,** 77-98.

VEHRENCAMP, S. L. (1983) A mmodel for the evolution of despotic versus egalitarian societies. *Animal Behaviour,* 31**,** 667-682.

WALDRON, D. A. (1998) Status in Organizations: Where Evolutionary Theory Ranks. *Managerial & Decision Economics,* 19**,** 505-520.

WALLNER, B., MACHATSCHKE, I. H. & FIEDER, M. (2008) *Occupational Ethology: A New Perspective in Occupational Stress Research,* Orlando, Int Inst Informatics & Systemics.

WALTERS, J. R. & SEYFARTH, R. M. (1987) Conflict and cooperation. IN SMUTS, B. B., CHENEY, D.L., SEYFARTH, R.M., WRANGHAM, R.W., STRUHSACKER, T.T. (Ed.) *Primate Societies.* Chicago, University of Chicago Press.

WATTS, D. P. (1996) Comparative socio-ecology of gorillas. IN MCGREW, W. C., MARCHANT, L. F. & NISHIDA, T. (Eds.) *Great Ape Societies.* New York, Cambridge University Press.

WEST, S. A., EL MOUDEN, C. & GARDNER, A. (2011) Sixteen common misconceptions about the evolution of cooperation in humans. Evolution and Human Behavour, 32, 231-262.

WHITE, F. J. & WRANGHAM, R. W. (1988) Feeding competition and patch size in species Pan paniscus and Pan troglodytes. *Behaviour,* 105**,** 148-164.

WHITTEN, P. L. (1983) Diet and dominance among female vervet monkeys (Cercopithecus aethiops). *American Journal of Primatology,* 5**,** 139-159.

WILKINSON, R. G. (2000) *Mind the Gap: Hierarchies, Health, and Human Evolution,* London, Weidenfels and Nicolson.

WILLIAMSON, O. E. (1975) *Markets and Hierarchies, Analysis and Antitrust Implications,* New York, Free Press.

WILLIAMSON, O. E. (1985) *The Economic Institutions of Capitalism,* New York, Free Press.

WITTIG, R. M. & BOESCH, C. (2003) Food competition and linear dominance hierarchy among female chimpanzees of the Tai National Park. *International Journal of Primatology,* 24**,** 847-867.

WRANGHAM, R. W. (1980) An ecological model of female-bonded primate groups. *Behaviour,* 75**,** 262-300.

WRANGHAM, R. W. (1987) Evolution of Social Structure. IN SMUTS, B. B., CHENEY, D. L., SEYFARTH, R. M., WRANGHAM, R. W. & STRUHSACKER, T. T. (Eds.) *Primate Societies.* Chicago, University of Chicago Press.

WRANGHAM, R. W. (1999) Evolution of coalitionary killing. *Yearbook of Physical Anthropology 1999, Vol 42.* New York, Wiley-Liss, Inc.

WRANGHAM, R. W. (2001) Out of the Pan, into the Fire: How Our Ancestors Depended on What They Ate. IN DE WAAL, F. B. M. (Ed.) *Tree of Origin: What Primate Behavior Can Tell Us about Human Social Evolution.* Cambridge, Harvard University Press.

WRANGHAM, R. W. & PETERSON, D. (1996) *Demonic Males: Apes and the Origins of Human Violence,* Boston, Houghton Mufflin.

List of Figures

Summary

This master thesis aims at providing a more complete understanding of what are the underlying mechanisms of cooperation and competition and the behavioral transition from one to another. Since behavioral economic research about the social preferences of economic agents chooses the framework of evolutionary biology it will start by depicting the roots of sociality from an ecologic as well as an evolutionary perspective. This will allow mirroring the multiplicity of influence factors that shaped and still frame social organization and social structure in human societies. As will be shown it is furthermore of major importance to highlight the evolution of hierarchies in primates and the resulting adaptations in social and especially political behavior. The following part will deepen the understanding of the mentioned evolved behaviors by reviewing the main findings of behavioral and experimental economic studies of the last twenty years. Afterwards it will be critically evaluated whether these findings are reasonable or not. As a synthesis of the previous descriptions some structural errors and possible misconceptions of social preference theory are stressed out. Following this, a short excursus into the reasons for the socioeconomic status (SES) research being stuck in finding an answer to the question why ranks do impinge on health is provided. This is done with regard to Occupational Ethology (Wallner *et al.*, 2008) as a presented research project aiming at an investigation of the roots of sociality and consequences of lacking adaptive abilities towards modern workplace structures of agents. Due to its interdisciplinary background, Occupational Ethology is somewhat a convergence point for the different branches dealing with the mechanisms of failing cooperation and may thus overcome the limits social preference theory faces.

Zusammenfassung

Ziel der vorliegenden Arbeit ist es, die grundlegenden Mechanismen kooperativem sowie kompetitivem Verhaltens zu erläutern. Da gerade in den letzten Jahren vermehrt versucht wurde, Ergebnisse verhaltensökonomischer Studien auch anhand evolutionsbiologischer Hypothesen über das Verhalten von Menschen zu erklären, werden in einem ersten Schritt die Grundannahmen der evolutionären Biologie und Anthropologie über das Entstehen und die Entwicklung kooperativer Verhaltensmuster aufgeführt.

Da die Organisationsstruktur der Gruppe substanziellen Einfluss auf die adaptierten sozialen und kompetitiven Verhaltensstrategien von Individuen nimmt, wird des weiteren ein besonderer Fokus auf die Evolution hierarchischer Strukturen, sowohl beim Menschen, als auch bei nicht menschlichen Primaten, gelegt.

Die folgende Zusammenfassung der wichtigsten Ergebnisse verhaltensökonomischer Studien über das Entstehen und die Charakteristika sozialer Präferenzen komplettiert den Stand der Forschung und erlaubt eine kritische Evaluation der heutigen Sichtweise kooperativen Verhaltens. Hierdurch ist es möglich einige strukturelle Fehler der experimentellen Forschung, sowie mögliche Fehlinterpretationen kooperativer Verhaltensstrategien aufzudecken. Es zeigt sich, dass die interdisziplinäre Orientierung der verhaltensökonomischen Forschung über soziale Präferenzen diverse Probleme mit sich bringt.

Ein kurzer Exkurs in die aktuellen Fragestellungen der Forschung zum sozio-ökonomischen Status, soll auf der einen Seite noch einmal die Wichtigkeit der sozialen Struktur als möglichen Steuerungsmechanismus sozialer Präferenzen herausstellen. Auf der anderen Seite soll hierdurch ein interdisziplinäres Forschungsprojekt, Occupational Ethology (Wallner *et al.*, 2008) vorgestellt werden.

Ziel dieses Projektes ist es, genau an der Schnittstelle zwischen Kooperation und Wettbewerb in der Hierarchie zu forschen und soziale Strategien und deren Folgen zu erklären.

Curriculum Vitae

Persönliche Daten

Name	Johannes Jäschke
Geburtsdatum	09.09.1982
Geburtsort	Düsseldorf, NRW, Deutschland
Staatsbürgerschaft	Deutsch
Adresse	Faulmanngasse 5/4
	1040 Wien, Österreich
E-Mail	jaeschke.j@gmail.com

Ausbildung

Seit 2010	Masterarbeit am Institut für Volkswirtschaftslehre, Universität Wien, Österreich
Seit 2010	Masterstudium VWL, Universität Wien, Österreich
2010	Abschluss Bakk.rer.soc.oec.
2006-2010	Bakkalaureatsstudium VWL, Universität Wien, Österreich
2006	Vordiplom BWL, Universität zu Köln, Deutschland
2004-2006	Diplomstudium BWL, Universität zu Köln, Deutschland
2003-2004	Diplomstudium BWL, Universität Oldenburg, Deutschland
2002	Abitur, Goethegymnasium, Düsseldorf, Deutschland
1993-2002	Goethegymnasium, Düsseldorf, Deutschland
1989-1993	Grundschule Gutenberg-Schule, Düsseldorf, Deutschland