FAIRNESS IS A VIRTUE IN COOPERATION

Wang Yihong[*]

127 Xinwenhua Jie Xicheng District Beijing, 100031 China

Abstract

The paper argues that fairness is an idealization in human cooperative behaviour for exploring the three kind of cooperative behaviours contains mutualism, altruism, and selfishness. I argue that fairness in evolution of cooperation is an ambiguous, because fair acts in human cooperative behaviour must be constrained by psychological constraint, and by social constraint, and by political constraint, and by moral constraint. The process can be clarified by a hybrid model of fairness in evolution of cooperation. I argue that fairness is a virtue in evolution of cooperation from human morality. Fairness is being, however, will push forward the development of human cooperative behaviour.

Keywords: morality, fairness, mutualism, altruism, selfishness, cooperation

1. Introduction

Why fairness is a virtue in cooperation? Baron claimed that fairness represented the do-no-harm principle in cooperation [1, 2]. For this reason, fairness is either reciprocal altruism [3-9] or mutualism [10] in cooperation. Fairness might in principle be constrained by outcome of mutually advantageous interactions from the benefits of cooperation. In particular, the advantage in fairness may treat mutualistic models of cooperation either partner control or partner choice, and these factors cannot neglect individual has mental states of altruism and selfishness [11]. Moral excellence of fairness will directly be limited by morality.

The first, many researchers describes fair acts in cooperation within Biology and Economics. For example, do-no-harm principle are tied in with reciprocity [1, 2, 6], fairness of reciprocity are influenced on the intertwined between altruistic action and selfish action in the evolution of cooperation [3-5, 11-17]. Second, many researchers show that human cooperative behaviour can directly produce a maximal benefit to one in each cooperation groups, or economical behaviour can sufficient to explain fair acts in cooperation [18-20]. For example do-no-harm principle, Knobe effect, Prisoner's dilemma, ultimatum game, public goods game, and so on. Finally, I will analyze human cooperative behaviour in Section 2, 3 and 4, to explore a hybrid model of fairness for explaining fair acts in cooperation in Section 5.

---

[*] Freelance writer, e-mail: dcyhm@sina.com

2. Mutualism

According to Axelrod and Hamilton, mutualisms are characteristic of situations where continued association is likely, and normally they involve quasi-permanent pairing of individuals or of endogamous or asexual stocks, or of individuals with such stocks. On the one hand, mutualisms are mutual cooperative of situations where continued representation is rigidly, and rationally they involve the partners in group cooperation or with each other incoming money, or food [18] through the differential games such Prisoner's dilemma [11, 12, 21-25], ultimatum game [18, 21, 23, 25], public goods game [6, 18, 21, 23, 25], and so on. On the other hand, Baumard et al. argue that economic game theory may be precisely explained by assuming that participants aim at fair allocation and that what they judge fair varies with their understanding of participants rights in the money to be allocated. I think that mutualistic behaviour is being companies with selfish acts by partners. In particular, game theory can demonstrate the conclusion.

Fairness in mutualistic cooperative behaviour is realism in accordance with moral judgment [2], and beneficial cooperative behaviour [26], and social behaviour [5, 13, 21, 27]. These evidences show mutual cooperation will focus on the strategies and conditions of evolutionary of cooperation to be a stable form in between the cooperative groups, and in between people in the partners from each group [6, 26]. The basic behaviour of cooperation told us: if individuals can share the spoils obtained in the cooperative enterprise, then cooperation will go on. Nevertheless, mutualism of collaborative partner may influence on these problems are such that social dilemmas [21, 26, 27] and moral judgment [2, 20] can be discussed.

Hamilton suggested mutual acts of cooperation can be understood as: mutual help occurs need not be very high before the condition for an advantage to inclusive fitness is fulfilled; and for grooming within actual families, of monkeys for instance, it is quite obviously fulfilled [16]. Perhaps mutual acts need be limited by social behaviour and by moral behaviour in human society, thus the phenomena of mutualistic cooperative behaviour will be constrained by psychological constraint, and by political constraint, and by moral constraint in evolution of cooperation [20]. I believe that fairness as a baseline in cooperation is that it appearing at mutual acts of cooperation, which may influence the development of cooperative behaviour in the differential groups cooperation, if so will influence one in each group.

Mutually beneficial behaviour in evolution of cooperation interest is one in a group cooperation benefit to the partners who is gaining their desired profit in economics. The hypothesis is possible. However, human cooperative behaviour will bear to the principle of do-no-harm [1]. In fact, the base do not neglect partner choice, and partner control in mutualistic models of cooperation. For example, female bias for mating with ornamented males select for more elaborate male displays, and the advantage of having sons with extreme displays, select for stronger preference in sexual selection by female choice. But the

behaviour is not mutualism, rather is selfishness when they known themselves be hoodwink by sexual partner. Because women grieving a romantic relationship breakup during acute grief; which study is needed to understand the relationship between normal sadness, grief, and depression can be demonstrated [28]. Of course, social behaviour is being in mutualistic cooperation. For example, Melis and Semmann suggested that social dilemmas apply to both types of cooperative behaviour: (1) investment behaviour that creates public benefit and (2) self-serving mutually beneficial behaviour in groups [26]. I consider, therefore, mutualistic cooperative behaviour will focus on a greater benefit to the partners who in a group cooperation.

According to do-no-harm principle [1, 2], fairness in cooperative behaviour is mutualism, but it need be understand altruist act, and selfish act in the evolution of cooperation. In morality, fairness is a plausible interpretation of evolutionary cooperation will make the partners who gather a greater benefit to cooperation, e.g., sharing rates (for review, Prisoner's dilemma, and ultimatum game, and public goods game), welfare trade-off ratio [29-31], and 'tit-for-tat' strategy [14]. Fairness in mutual cooperation will make some constraints to gather the frequent ease of cheating in reciprocatory arrangements from individuals, or mutualism will appear more questionable in evolution of cooperation from group cooperation, and from one in it [1, 2, 6, 7, 32].

3. Altruism

Altruistic acts in human cooperative behaviour have an important property of psychological mechanism, because one's altruistic behaviour in the partners in group would be fully explained when his intention, and his desire, and his dark side were shown to process the requisite internal altruistic mechanism [11]. Altruistic behaviour can be defined as behaviour that benefits another organism, not closely related, while being apparently detrimental to the organism performing the behaviour, benefit and detriment being defined in terms of contribution to inclusive fitness from the version of Trivers [4]. For example, humans many different control mechanism, such as reward, punishment, ostracism, reputation building are appearing in cooperation [26]. These bases demonstrated altruistic behaviour is help people to collaborate in cooperation with each other, or we must be believed altruist behaviour satisfied do-no-harm principle [1, 2].

For these reasons, fairness in altruistic behaviour has a stable state of psychological mechanism, but it does not reject some social constraints includes self-serving bargaining [26, 33, 34], moral preference and moral constraint [2, 20] in cooperation. For example, altruistic behaviour and reconciliation behaviour of monkey can be modified by social experience [35, 36]. Many psychologists and economists are clarifying the reciprocity of altruistic in evolution of cooperation [4-7, 11, 13, 14, 32, 33], is an action in human and non-human animals, that it benefits a recipient at a cost to the actor intended to benefit the other [36].

We ought to believe that a large part of human altruism and a still larger part of non-human altruism can well be explained in terms of inherited mechanisms based on genetic overlap, for example the ant's self-sacrifice in defence of a communal nest would differ from a mother bear's care for her cubs [11]. After Rachlin's example that the woman who runs into a burning building to save someone else's child does so not by activating an innate self-sacrificing tendency but by virtue of the same learning process she uses to control her smoking, drinking, or weight. The idea shows that human altruistic actions is selfish altruistic actions [36], or is mutual consequence of desired cooperation adopted by altruism itself. The hypothesis is possible; however, which will be controlled by morality, and by psychological constraint, and by social constraint, and by political constraint to process cooperation.

For these reasons, altruistic acts in evolution of cooperation are selfish acts when one in the group cooperation selects a greater benefit to give other who for achieve other intention in further. For example, Trivers' altruistic models clarifies many altruistic situations are such that: (1) random dispensation of altruism, (2) non-random dispensation by reference to kin, and (3) non-random dispensation by reference to altruistic tendencies of the recipient [4]. Altruistic action in evolution of cooperation can add to the genotype-reproduction of neural selection [37, 38] and reciprocal altruism [3-9, 39] accepts with risk behaviour or disadvantage [3]. For these evidences, altruistic acts may happen to kinship care for later generations reward fitness benefits in human society. In general, human altruistic behaviour differs from animal self-sacrifice in group selection.

Alexander argued that "man is basically cooperative and altruistic is no less instinctivist than its counterpart that he is basically aggressive and competitive" [5, p. 329]. Perhaps fairness in altruistic behaviour do no explanation, as in human society we need be consider that nepotism extend outside the parent-offspring relation, and ought to consider the conflict between male and female parents have the complex social behaviours [5, 8, 11, 22]. Altruism and moralism are difficult to distinguish because of the possibility of paternalistic altruism [2]. However, fairness in altruism will lose moralistic role played in the parents selected their recipient, or more specification will become a kind of risk behaviour either mutualistic cooperation is selfish altruist by self-interest.

4. Selfishness

Selfishness is also an action of cooperation, it provide 'selfish' regardless of whether or not the actor deliberately seeks benefits in cooperation [36]. Self-interest focus on a person gains a greater benefit for selfishness itself, in theoretical, which is a harm behaviour in cooperative behaviour. Many researchers suggest that selfish acts in cooperation would bear to the manifest properties benefits to the development of cooperation, for instance, the conflict between individual payoffs and group payoffs is maximal in social dilemmas

because individuals always receive higher rewards for choosing the option leading to the deficient equilibrium that no one desires [22], whether increasing cognitive abilities invariably help the evolution of cooperative behaviour or whether they may in some circumstances hinder it [40], individuals will stay in the group and forego direct reproduction only when such an act provides either direct benefit or because individuals can increase the reproductive output of related individuals [8], individuals were reluctant to harm one group to benefit another group more [1], selfish and altruistic oftentimes conflicts with their vernacular meaning [36], and so on.

For these reasons, selfish action is a general behaviour in cooperation. If selfish action does not consider, hunt, and harm other individuals' gains the costs and benefits, then it is positive. By contrast, selfishness will be punished. The hypothesis is possibility when human cooperative action will be constrained by moral constraints, and by philosophical constraints, and by political constraints, and by social constraints in Section 5. These conditions are focusing on a key problem as human cooperative behaviour must be considering them.

Punishment and reward will construe the nature of fairness in game theory [8, 11, 17, 22, 32, 41-46]. In morality, fairness in evolution of cooperation may describe the nature of individuals increased benefit in group cooperation either mutualist or altruist. Fairness in selfishness will by limited by some conditions includes psychological constrain, social constrain, and political constrain in accordance with social dilemmas and moral preference, and political laws in between the partners of cooperation, or the groups of, or more much. For example, Baumard et al, argues that model of mutualistic cooperation is consisting of model of partner choice and partner control for explain mutually beneficial to actor and recipient.

Cooperation produces benefits that are hard or impossible to attain by any individual alone, the resulting behaviour is essentially self-serving even if it benefits others at same time [39]. Selfishness is only happening to cooperative behaviour, and is often harming other partners benefit. As if one's selfish acts may be harmed another benefits in the same group cooperation, or it must be harmed another group benefits in cooperation to occur.

Self-serving bias seems to be an important phenomenon when individuals can rely on several rules when they have to make fairness decisions. The base shows that fairness might lose when selfish action is being in cooperative behaviour in humans, and that fairness might be ambiguous when selfish action is being in the both mutualistic cooperation and altruistic cooperation, rather than the constrained selfish action might push forward the development of evolution of cooperation in humans.

5. A hybrid model of fairness in between morality and its constraints

Rabin argued that people like to help those who are helping them, and to hurt those who are hurting them [20]. The behaviour can clarify the nature of fairness in human cooperative behaviour, and can satisfy to do-no-harm

principle [1, 2]. Well-known fairness equilibriums will be constrained by morality, and by social constraint, and by political constraint, and by psychological constraint when these constrain conditions are being in human cooperative behaviour in accordance with classic theories of evolution of cooperation [see 1, 2, 20, 41, 42, 47, 48]. These conditions will make fairness in cooperation bias to the differential properties of cooperative behaviour are such that mutualistic cooperation, altruistic cooperation, and selfish cooperation in humans, in particular economic behaviour for them. More general, moral constraints and social constraints are concerning reciprocity of fairness in humans [1, 2, 42, 47, 48].

Trivers's arguments analyzed the psychological system underlying human reciprocal altruism [4]. If Trivers is correct, then psychological constraints will concern to human cooperative behaviour. For example, Rabin presents a model fleshing out one possible distinction between moral preference and moral constraints, and relates the distinction to self-serving biases in moral reasoning [M. Rabin, *Moral preferences, moral constrains, and self-serving biases*. Berkeley Working Paper No. 95-241, University of California, 1995]. Rabin's evidences demonstrated moral constraints include psychological constraint, social constraint, and political constraint.

Human morality will influence on the human cooperative behaviour; however, this generate social influences will advance in the basics contains all cooperative behaviour, e.g., mutualist, altruist, and selfness [1, 2, 20, 24]. Reciprocity of fairness in evolution of cooperation is a puzzle when many researchers noted fairness is not only a special form of reciprocal altruism [3-7, 9, 13-16], rather than as mutualism, or as selfish altruism [10]. I consider, therefore, fairness in evolution of cooperation is idealization. However, partner who in group cooperation desires playoff incomes is a greater benefit for themselves, and do not hunt other benefit. This seem as an interpretation of fairness in evolution of cooperation when individual behaviour will determine the nature of fairness, for example, social dilemmas lead to individual to select his (or her) partners in group cooperation for increase his (or her) benefits in cooperation.

Rabin demonstrated incorporating fairness and moral constraints is measurable, and give rise to self-serving biases in moral reasoning used game theory in economics [20]. The method suggests moral dispositions are internal constraints on a person's real goal of pursuing her self-interest; she will be keen to self-servingly gather, avoid, and interpret relevant evidence, for the purpose relaxing this constraint and pursuing her self interest. If Rabin is true, then moral dispositions will gather, improve, and push forward the development of evolutionary cooperation in economics. More general, many scientists discusses human morality influences on the human cooperative behaviour within economics [1, 2, 20, 24, 26, 49, 50]; however, these evidences show that fairness in human cooperative behaviour is hard process different form animals have a single structure to be the basic of natural selection [3-5, 8, 16, 26, 27, 37, 38, 51, 52], e.g., group selection and sexual selection.

For these reasons, human cooperative behaviour have the all of those properties contains altruism, mutualism, and selfishness in evolution of cooperation in economics. I argue that fairness in morality as the baseline of makes humans' moral beings, such altruistic acts and mutualistic acts to explain human cooperative behaviour does not clarifies the virtue of fairness in Figure 1. Seem as, fairness can not like as the definition to being, rather than like as a virtue to constrain the extremes self-serving biases, and to push forward the development of cooperative behaviour in economics. Figure 1 show that a hybrid model of fairness, and show that fairness is a idealization in between human cooperative behaviour and its constrain conditions includes psychological constraint, social constraint, political constraint, and moral constraint for explore evolution of cooperation.
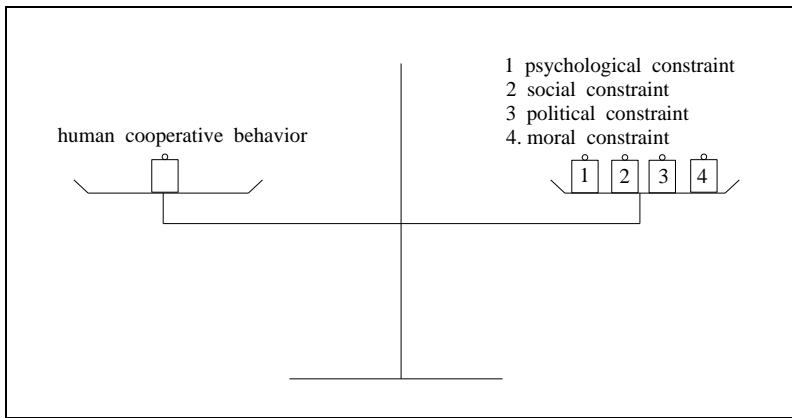

Figure 1. A hybrid model of fairness in morality, which will be constrained by psychological constraint, and by social constraint, and by political constraint, and by moral constraint from one in group cooperation.

I think that the nature of human morality may constrain a fair action happen to cooperative behaviour. Fair acts in cooperation have the best patterns either mutualistic action or altruistic action, but do not neglects selfish action companies with them to occur. The process of cooperation, therefore, fair action is being if and only if probability of those constrains conditions is greater than or equal to probability of human cooperative behaviour in Figure 2. The process can write as:

$$P\left(P_S + S_o + P_o + M_o\right) \geq P(H_u)$$

(1)

I believe that the hypothesis is correct, because moral constraints is measurable demonstrated by Rabin [20], by Fehr and Schmidt [32], by Baron [1, 2], by Hill and Gurven [23], by Cosmides and Tooby [24], by Kahneman, Knetsch and Thaler [50], and so on. As same reason, selfish action in human cooperative behavior is more general, but it does only not harm other partners' benefits companies with altruistic action and mutualistic action to occur.
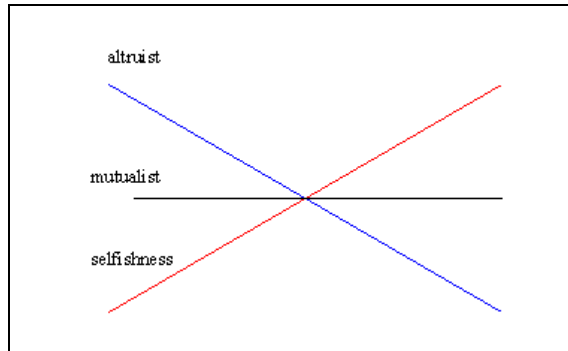
Figure 2. A hybrid model of fairness has three forms of human cooperative behaviour as altruist, mutualist, and selfishness, respectively.

A hybrid model of fairness give rise to the three possibilities influences on the fair act bias for the two sides either altruist or selfness in Figure 2. So that, model of fairness might solve human cooperative behaviour generate the outcomes derived social influences from cooperative environments and itself constrains preference. Figure 2 show that selfish action in evolution of cooperation is being and show that fair action in selfishness of cooperative behaviour is not being, if and only if probability of those constrains conditions is less than probability of human cooperative behaviour. The process can write as:

$$P\left(P_S + S_o + P_o + M_o\right) < P(H_u)$$

(2)

The model of fairness in evolution of cooperation is possible when one's benefits in group cooperation are greater than other in group. I trust that the behaviour is selfish altruist or is reciprocal altruist in evolution of cooperation. Because the role of fairness in cooperative behaviour has been described the relation of human cooperative behaviour and its some constrain conditions, the transformation include in between altruistic action and selfish action, and in between mutualistic action and selfish action.

I argue that fairness in evolution cooperation is solving the problems about the differential acts intertwines between altruistic act and multualist act, and between altruist act and selfish act, and between mutualistic act and selfish act appearing at human cooperative behaviour. The problems are failing to give rise to the manifest boundary distinction between them. I believe that the fact as they will happen to human cooperative behaviour at the same time. For example, one's greater benefits in reciprocal altruism do not hunt another one's benefit in human social behaviour [3, 4, 13-16, 20], rather than one's benefits in reciprocal altruism is a kind of selfish altruism [36]. Altruism can clarify parents' benefits care for later generations reward fitness benefits. Mutualistic behaviour is also a kind of reciprocal altruism in evolution of cooperation.

6. Conclusion

Fairness in evolution of cooperation may explore these behaviours contains altruist action, mutualistic action, and selfish action; and may clarify relationship between human cooperative behaviour and its some constrains conditions contains psychological constraint, social constraint, political constraint, and moral constraint in hybrid model of fairness in morality. I argue that fairness is a puzzling concept in evolution of cooperation, and it is a virtue in evolution of cooperation from human morality. Fairness is being; however, will push forward the development of human cooperative behaviour.

References

[1]   J. Baron, Journal of Behavioral Decision Making, **8** (1995) 71-83.
[2]   J. Baron, Synthese, **172** (2009) 7-35.
[3]   W.D. Hamilton, Am. Nat., **97** (1963) 354-356.
[4]   R.L. Trivers, Q. Rev. Biol., **46** (1971) 35-57.
[5]   R.D. Alexander, Ann. Rev. Ecol. Syst., **5** (1974) 325-383.
[6]   E. Fehr and S. Gächter, European Economic Review, **42** (1998) 845-859.
[7]   E. Fehr and S. Gächter, Journal of Economic Perspectives, **14** (2000) 159-181.
[8]   L. Lehmann and L. Keller, Evol. Biol., **19** (2006) 1365-1376.
[9]   S.F. Brosnan and F.B.M. de Waal, Human Nature, **13** (2001) 129-152.
[10]   D.H. Boucher, S. James and K.H. Keeler, Ann. Rev. Ecol. Syst., **13** (1982) 315-347.
[11]   H. Rachlin, Behav. Brain Sci., **25** (2002) 239-296.
[12]   A.M. Colman, T.W. Körner, O. Musy and T. Tazdait, J. Math. Psychol., **55** (2011) 166-175.
[13]   R.D. Alexander and G. Borgia, Ann. Rev. Ecol. Syst., **9** (1978) 449-474.
[14]   R. Axelrod, *The Evolution of Cooperation*, Basic books, New York, 1984.
[15]   R. Axelrod and W.D. Hamilton, Science, New Series, **211** (1981) 1390-1396.
[16]   W.D. Hamilton, J. Theoret. Biol., **7** (1964) 1-52.
[17]   A.M. Colman, *Evolution of cooperation without awareness in minimal social situations*, in *Teamwork: Multi-disciplinary Perspectives*, N. Gold (ed.), Palgrave Macmillan, Basingstoke, 2005, 216-235.
[18]   M. Gurven, Experimental Economics, **7** (2004) 5-24.
[19]   M. Gurven, Behav. Brain Sci., **27** (2004) 543-583.
[20]   M. Rabin, American Economic Review, **83** (1993) 1281-1302.
[21]   P. Kollock, Annu. Rew. Sociol. **24** (1998) 183-214.
[22]   L.R. Caporael, R.M. Dawes, J.M. Orbell and A.J.C. van de Kragt, Behav. Brain Sci., **12** (1989) 683-739.
[23]   K. Hill and M. Gurven, *Economic experiments to examine fairness and cooperation among the Ache Indians of Paraguay*, in *Foundations in Human Sociality: Economic experiments and Ethnographic Evidence from Fifteen Small-Scale Societies*, J. Henrich, R. Boyd, S. Bowles, C. Camerer, E. Fehr and H. Gintis (eds.), Oxford University Press, Oxford, 2004, 382-412.
[24]   L. Cosmides and J. Tooby, *Evolutionary psychology, moral heuristics, and the law*, in *Heuristics and the Law*, G. Gigerenzer and C. Engel (eds.), MIT Press, Cambridge, 2006, 181-212.

[25] J. Henrich, R. Boyd, S. Bowles, C. Camerer, E. Fehr, H. Gintis, R. McElreath, M. Alvard, A. Barr, J. Ensminger, N. S. Henrich, K. Hill, F. Gil-White, M. Gurven, F. W. Marlowe, J. Q. Patton, and D. Tracer, Behav. Brain Sci., **28** (2005) 795-855.

[26] A.P. Melis and D. Semmann, Phil. Trans. R. Soc. B, **365** (2010) 2663-2674.

[27] R.M. Dawes and D.M. Messick, International Journal of Psychology, **35** (2000) 111-116.

[28] A. Najib, J.P. Lorberbaum, S. Kose, D.E. Bohning and M.S. George, Am. J. Psychiatry, **161** (2004) 2245-2256.

[29] J. Tooby and L. Cosmides, Ethology and Sociobiology, **10** (1989) 29-49.

[30] J. Tooby and L. Cosmides, *Group in mind: The coalitional roots of war and morality*, in *Human Morality and Sociality: Evolutionary and Comparative Perspective*, H. Høgh-Olesen (ed.), Palgrave Macmillan, New York, 2010, 191-234.

[31] H.C. Barrett, L. Cosmides and J. Tooby, Communicative & Integrative Biology, **3** (2010) 522-524.

[32] E. Fehr and K. M. Schmidt, The Quarterly Journal of Economics, **114** (1999) 817-868.

[33] E. Fehr and U. Fischbacher, Nature, **425** (2003) 785-791.

[34] L. Babcock, G. Loewenstein, S. Issacharoff and C. Camerer, The American Economic Review, **85** (1995) 1337-1343.

[35] F.B.M. de Waal, Science, **289** (2000) 586-590.

[36] F.B.M. de Waal, Annu. Rev. Psychol., **59** (2008) 279-300.

[37] C. Darwin, *On the Origin of Species*, Electronic Classics Series, J. Manis (ed.), Pennsylvania State University, Hazleton, PA 18201-1291, 1859/2001.

[38] G.C. Williams, *Adaptation and Natural Selection: A Critique of Some Current Evolutionary Thought*, Princeton University Press, Princeton, 1966.

[39] F.B.M. de Waal and M. Suchak, Phil. Trans. R. Soc. B., **365** (2010) 2711-2722.

[40] S.F. Brosnan, L. Salwiczek and R. Bshary, Phil. Trans. R. Soc. B., **365** (2010) 2699-2710.

[41] T.H. Clutton-Brock and G.A. Parker, Nature, **373** (1995) 209-216.

[42] J. Baron and I. Ritov, Journal of Legal Analysis, **1** (2009) 553-590.

[43] J. Balcombe, Applied Animal Behavior Science, **118** (2009) 208-216.

[44] R. Boyd and P.J. Richerson, Ethology and Sociobiology, **13** (1992) 171-195.

[45] H. Gintis, S. Bowles, R. Boyd and E. Fehr, Evol. Hum. Behav., **24** (2003) 153-172.

[46] A.M. Colman and L. Browning, Evol. Ecol. Res., **11** (2009) 949-963.

[47] J.A. Stevens and M.D. Hauser, Trends Cogn. Sci., **8** (2004) 60-65.

[48] J.A. Stevens, F.A. Cushman and M.D. Hauser, Annu. Rew. Ecol. Syst., **36** (2005) 499-518.

[49] B.F. Malle, Journal of Cognition and Culture, **6** (2006) 61-86.

[50] D. Kahneman, J.L. Knetsch and R. Thaler, The American Economic Review, **76** (1986) 728-741.

[51] D.S. Wilson, Proc. Nat. Acad. Sci. USA, **72** (1975) 143-146.

[52] E.O. Wilson, *Sociobiology, the new synthesis,* Harvard University Press, Cambridge, 1975.