

# MPRA

Munich Personal RePEc Archive

## The Gift and the Centipede

Egbert, Henrik

23 July 2017

Online at <https://mpra.ub.uni-muenchen.de/80324/>  
MPRA Paper No. 80324, posted 23 Jul 2017 08:07 UTC

## The Gift and the Centipede

Henrik Egbert  
Anhalt University of Applied Sciences  
Department of Economics  
Bernburg, Germany  
henrik.egbert@hs-anhalt.de

*This paper addresses the similarity between behavioural economics and social anthropology with respect to approaches on repeated reciprocity. The case at hand is the application of the Centipede game to Marcel Mauss's concept of the Gift. In a Centipede game players interact in an alternating sequence of decisions to take or to pass an endowment. Mauss describes sequences of reciprocal giving in potlatch cultures, in which strict obligations determine choice options. The paper shows that models developed in behavioural economics, such as the Centipede game, can also be applied to prominent contexts in economic anthropology.*

**Keywords:** Gift, Centipede game, Potlatch game, Marcel Mauss, reciprocity

### Introduction

The work of Marcel Mauss is mostly unknown to economists. Only few references to the *Gift*, Mauss' best known work, are to be found in the economic literature (e.g. Kranton, 1996). This is also true for behavioural economics even if authors from this field regularly address topics such as reciprocity and other forms of non-selfish behavior. These topics are closely related to the *Gift*. Economic anthropologists also tend to be scarcely aware of the developments in behavioural economics and the related research methods and findings. They appear, instead, to nourish the long established enemy image of neoclassical theory (e.g. Hann & Hart, 2011). By and large, applications of behavioural economics methodologies are rarely found (but see Henrich, 2000; Henrich et al., 2001).

Mutual acceptance of key concepts and knowledge about different methodologies of the other discipline, however, may be fertile ground for developing existing concepts further. This short note addresses a specific case. It states that the concept of the *Gift*, as developed by Marcel Mauss (1923/1924) nearly 100 years ago, can serve as a contextual framework of the Centipede game. The Centipede game is one of the workhorses used in behavioural economics and it has been tested in many different variations in the lab and in the field. The purpose of this note is not only to bring Mauss's work to the attention of economists, but also to attract anthropologists' attention to methods used in economics which can be fruitfully applied to their research topics.

The structure of the text is as follows: Section 2 briefly outlines the idea of the Gift. Section 3 introduces a standard Centipede game and provides a short literature review

of empirical findings. Section 4 sets the Centipede game in the context of the Gift and addresses similarities and dissimilarities. Section 5 is dedicated to the discussion of game trees. The last section concludes.

## **The Gift**

Marcel Mauss's (1990) concept of the *Gift* has to be considered within his general approach to society. According to him individual decisions depend on both individual freedom and social obligations (Hart, 2007:481). Mauss (1990:70) writes that a citizen "[...] must act by taking into account his own interests, and those of society and its subgroups." In this sense a person acts as an individual within a given social context.

Mauss (1990:39-43) examines the Gift in specific potlatch cultures and also in a European historical context and refers to three immanent obligations. Firstly, he addresses the 'obligation to give'. This obligation is central for groups and for individuals within a given social order as to preserve a social position through the signalling and demonstration of wealth, fortune, being blessed by the spirits and gods, etc. This obligation goes hand in hand with a compulsory invitation to gift giving occasions, i.e. the spread of information to all potential receivers of gifts before a gift-giving occasion, for instance the invitation to a feast. Secondly, the invited are 'obliged to accept' the invitation. They have only few reasons to refuse. Moreover, a 'burden' (Mauss, 1990:41) is attached to the gift and its acceptance. This burden becomes obvious in the third obligation, i.e. recipients of a gift have the 'obligation to reciprocate' in the future. In the specific form of the potlatch, the value of the reciprocation should be higher than the value of the gift received. Indeed, with the fulfilment of this third obligation a new round of reciprocal exchange is likely to start. Any violation of these obligations, e.g. not to invite, to decline an invitation, to reject a gift, or an insufficient reciprocation of the gift, inevitably has social consequences for the offender or her group. Social costs can be a loss of social esteem, status, power, etc.

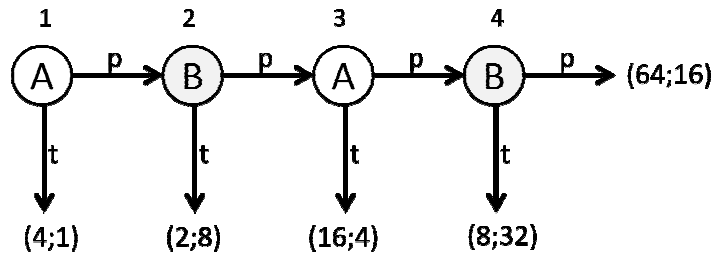
Mauss's *system of total services* can be understood as a decision and allocation system within an institutional setting. It includes collective entities, rules and obligations for exchange (Douglas, 1990:5). Mauss regards families, clans and tribes as collective entities who engage in exchange. Exchange in this system is compulsory and ubiquitous. Douglas (1990:5) provides examples for exchange objects and occasions such as banquets, rituals, military services, human beings, and cultural activities. An initial gift induces reciprocal returns and a permanent exchange within a society. On the one hand, a gift stabilizes social relations between individuals and groups. On the other hand, reciprocal exchange has a strong competitive element if one group or individual tries to outperform opponents. It is important to note that, according to Mauss, the Gift is understood as a universal pattern (see Hann, 2006:208; Liebersohn, 2011:139-163; Mauss, 1990:71-83) and can be applicable to modern market exchange as well as to archaic exchange (see also Hart, 2007). Recently, Egbert and Sedlarski have pronounced the compatibility of Mauss's ideas with concepts in new institutional economics and business administration (Egbert, 2017; Egbert & Sedlarski, 2016).

## **The Centipede Game**

Economic experiments prove that people do not always take decisions as predicted by neoclassical theory. In many cases individuals do not behave selfishly. A case at hand is the Centipede game (Rosenthal, 1981). In this game two players A and B take sequential decisions. We assume that player A is the first player. Player A has the option to take

‘something valuable’. In an experimental setting this ‘something valuable’ is usually tokens that represent money. In the game tree a higher value is indicated by a higher number. So maximizing the number of tokens would be a rational aim of a selfish person. If A does not take the tokens, she can pass them to player B. In this case B has the same two options, either to take or to pass. A game tree illustrates the situation in more detail.

Figure 1: A Centipede Game



Source: Adopted from McKelvy & Palfrey (1992:806).

The two players are A and B. The ‘take decision’ is indicated by  $t$  and the ‘pass decision’ by  $p$ . If a player chooses  $t$ , the game ends and both players receive their pay-offs. For instance, if A chooses  $t$  at her first node, the game ends (4;1). A receives four tokens (always the first number of the pay-off) and Player B receives one token (always the second number). But if A chooses  $p$ , then B has to take the same decision, i.e. to take or to pass. As it can be seen, the sum of the tokens always doubles when a player chooses to pass.

In neoclassical theory this would imply the assumptions that both players are rational and are fully informed about the structure of the game, all pay-offs, and about the final node. A player maximizes her utility through the maximization of her pay-offs. Since a terminal node exists, the game can be solved by backward induction. If B compares at her last node her pay-offs between choices  $p$  and  $t$ , she chooses  $t$  because  $32 > 16$ . If A assumes that B is rational at node 4 and will choose  $t$ , A’s best choice at node 3 is  $t$  because  $16 > 8$ . Thus the backward induction with rational players allows predicting the subgame perfect Nash equilibrium: both players choose  $t$  as early as possible. In this case A would stop at her first node and reciprocal behaviour would not be possible to occur.

However, empirical studies do not confirm that individuals play the Nash equilibrium. Only few players stop the game as early as possible. McKelvy & Palfrey (1992) are the first who test the game experimentally. They find that only 7% of participants stop the game at the first node and most players stop after the first but before the last node. A large body of empirical and theoretical research was stimulated by this game (for brief surveys see Camerer, 2003:94-95, 219-221; Binmore, 2007:165-167, 416-418). Next, some empirical findings are summarized.<sup>1</sup>

Nagel & Tang (1998) confirm the results of McKelvy & Palfrey (1992) and additionally consider the learning effects. In a constant sum game in which one participant can only lose if she plays pass, Fey, McKelvey & Palfrey (1996) find that the percentage of participants who end the game early increases. Ho & Weigelt (2005) use a centipede game in order to investigate trust-building among strangers. Parco, Rapoport & Stein (2002) test the influence of high pay-offs in comparison with low pay-offs. High pay-offs induce participants to choose ‘take’ at earlier nodes of the game. Similar results are reported from

<sup>1</sup> The review is confined to selected games which allow observing direct reciprocity because this is the closest to the Gift concepts. Similar Centipede games can also be used to show indirect reciprocity (Greiner & Levati, 2005; Danese & Mittone, 2015).

a three-person game with nine stages (Rapoport et al., 2003). Palacios-Huerta & Volij (2009) conduct a field experiment with chess players and show that individuals who are trained in backward induction reasoning very often end the game early, i.e. their decisions are more in line with predictions derived from neoclassical theory. Other studies focus on cooperative behaviour. In an experiment with a mixed population of humans and robots, Murphy, Rapoport & Parco (2004) test how the number of cooperative players in a population influences outcomes. Bornstein, Kugler & Ziegelmeyer (2005) test the effect of groups as players and find that groups choose the ‘take’ option earlier than individual players.

These and a number of other studies<sup>2</sup> reveal those variables that increase the share of participants who stop the game comparatively early: a constant pie (Fey, McKelvey & Palfrey, 1996), very high stakes (Rapoport et al., 2003; Parco, Rapoport & Stein, 2002), more than two players (Rapoport et al., 2003), if groups and not individuals are the players (Bornstein, Kugler & Ziegelmeyer, 2005), and individual training in backward induction reasoning (Palacios-Huerta & Volij, 2009). They also show that participants play ‘take’ at later nodes if the percentage of cooperative players in the population increases (Murphy, Rapoport & Parco 2004), and if the game has many decision nodes.

### **The Centipede and the Gift**

Many similarities between the concept of the Gift and the Centipede game are apparent. Besides, there are also differences which require elaboration in order to make the game applicable to a Gift context. Next, the similarities are outlined before addressing the differences.

In a model two largely homogenous groups can be depicted by two individuals. For instance, player A and player B could be chiefs of clans or tribes who have similar preferences and interests similar to the groups they represent. If chief A provides chief B with an initial gift, this action can induce repeated direct reciprocal behaviour between the two chiefs. This is what is described in the Gift concept and is also depicted in Centipede games. In both contexts the initial endowment is exogenously given. In the Gift context, for instance, the initial gift could be the result of a particularly good harvest, in the Centipede game an experimenter provides the initial endowment.

Another structural resemblance is related to the second obligation outlined by Mauss (1990:41). It states that a gift must be accepted and can hardly be rejected by the receiver. That is exactly depicted in a Centipede game: If a player passes, the receiving player has no option to reject. Furthermore, when Mauss states that a ‘burden’ is attached to a gift, this burden is modelled in the pay-off structure of the game. The burden is the interest that a receiver has to repay with her reciprocal giving. In many Centipede games the interest can be found in the sum of tokens that a person passes because the sum steadily increases (see Figure 1).

There is also a similarity in the assumption of economic theories and Mauss that individuals exchange something of value. Mauss outlines in detail how ‘things’ that have a magic value for groups can become money within these groups (see Hahn, Schmidt & Seitz, 2015 for an anthology of Mauss’ writings on money). In order to make a ‘thing’ an appropriate object for exchange in groups, i.e. to serve as a gift, A and B (and the groups they represent) must have a similar value system with respect to these things. While in

---

<sup>2</sup> For a recent analysis based on verbal protocol taken during a Centipede game see Krockow, Colman & Pulford (2016).

some societies food, blankets, invitations, salt, or labour constitute such things, in other societies these things can be tokens which can be exchanged for money. Money, as used in economic experiments, is simply a specific case of a wide variety of possible valuable objects which could also be used in experiments. The innate assumption of the Centipede game and of the Gift is that those who interact in exchange have to possess similar value systems about the ‘things’ that are exchanged.

The third parallel is that empirical findings in anthropological research and in experimental economics show that many people do not always behave selfishly. Instead, they have other regarding preferences, reciprocity being one of them (Falk & Fischbacher, 2006). Thus empirical findings from the Centipede game and other experiments (e.g., the Trust game) go hand in hand with observations of direct reciprocal behaviour as described by Mauss for potlatches and other social arrangements.<sup>3</sup>

Apart from these similarities, there are differences as well. One difference is that in an experiment, players physically receive the *final* pay-off but not intermediate pay-offs. For instance, if player A chooses the take option at node three (Figure 1), then players physically receive 16, respectively 4 tokens but they do *not* receive tokens at nodes one and two because they have chosen to pass. In contrast to that, the Gift addresses a physical transfer of valuables every time when players interact. One may argue that the physical presence of the objects influences the decisions. If such an endowment effect (Thaler, 1980) exists, it is reasonable to assume that fewer players would pass at initial nodes. However, this is only a minor point since the game could be played with physical objects being given to the players at every node. The two remaining aspects address more striking differences. Both are related to the ‘obligations’, i.e. the institutional setting assumed in the Gift concept.

The above Centipede game does not include socially determined obligations. An anonymous player who ends the game by choosing the take option is not exposed to social costs. In the Gift concept social costs exist because it is an innate consequence of the ‘obligations’. Since in the Gift concept social rules dictate to give, to accept and to return, an individual in this institutional context will always accept and reciprocate if means allow her to do so and even if social costs are comparatively high. Social costs are, for instance, loss of reputation, loss of rank, or social exclusion which a society puts on the offender. If these costs are high, a decision maker will continue the process of reciprocal giving, once she has initially given a gift or has accepted one. The only option to avoid this repeated circle is to abstain from the first transfer (see the example given in Hann, 2006:209).

The other foremost difference is related to utility. In a Centipede game it is assumed that for a rational player her utility  $u$  increases with the number of tokens she receives. This means that more tokens are strictly preferred to fewer tokens. Thus the players’ utilities are related to the size of the pay-offs, for instance  $32 > 16$  implies that  $u_{(32)} > u_{(16)}$ .

In the concept of the Gift this is different. The utility for a person derives from the act of giving because giving is the visible fulfilment of an obligation, i.e. to pass something valuable to others. In the specific social context of a potlatch that includes aspects of religion and politics, to give away more goods is better, because generous giving means an increase of social esteem. Thus the ‘take’ decision, i.e. the decision *not* to give and *not* to share causes in the Gift context a lower utility than the ‘pass’ decision. The next section provides two game trees and outlines that the concept of the Gift can be described as Centipede games.

---

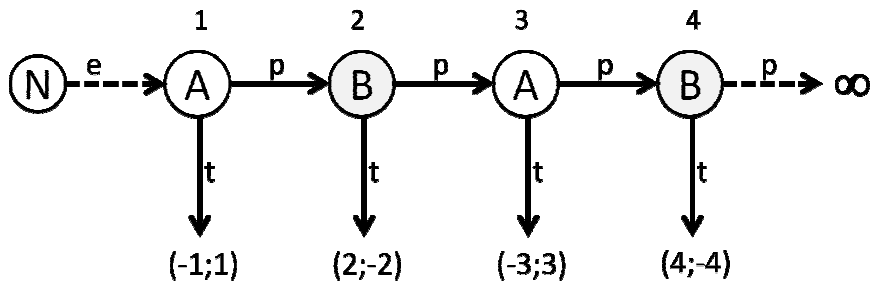
<sup>3</sup> This does not imply that in repeated interaction reciprocal behavior can be a form of utility maximizing behavior of selfish individuals.

## Potlatch Gift Exchange

Let us assume a potlatch context as Mauss and others have described it. All players have similar value systems and the three obligations are in power and constitute the normative institutional framework. A person (representative of a group) who possesses something valuable has to offer it as a gift at a specific occasion to another person (representative of another group). This second person has to accept and to reciprocate the gift with an interest at a later occasion. Both persons stand in competition for social rank, esteem, etc. Utility derives solely from giving, i.e. the decision to pass and social costs occur if norm violation occurs. An ex-ante determined final transfer does not exist so that the reciprocal exchange may continue infinitely. This implies that the game cannot be solved by backward induction.

Figure 2 depicts such a potlatch game. Nature (N) initially endows ( $e$ ) a player randomly with something valuable. This could be a very rich harvest or an unusually successful hunt. Player A has now the option to keep this endowment ( $t$ ), i.e. to use it herself. If she does so, she faces social costs indicated with a minus in her pay-off structure at node one  $(-1/1)$ . However, in this case A's decision also affects B's utility. Since A exhibits selfish behaviour, B derives a utility because A loses social esteem or social rank. That is why the pay-off for B at node one is positive  $(-1/1)$ . However, if A passes the valuables to B, then A would gain social esteem in case B chooses  $t$  at node two. In this case B would face social costs  $(2;-2)$ . The only rational decision for each player at her node is to pass, i.e. to behave reciprocally. Since an interest has to be paid on what has been received, the pay-offs in the game tree increase in absolute numbers depicting increasing utility or decreasing utility at higher nodes. For an infinite game the best decision for both players would always be to pass.

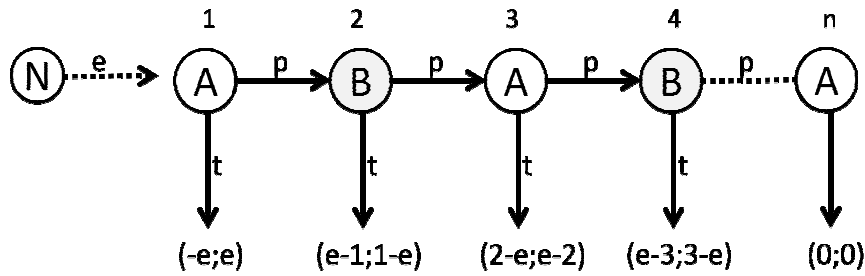
Figure 2: Potlatch Game



While the game in Figure 2 may visualise the concept of the Gift in a potlatch culture, it remains applicable to comparatively few situations or societies. This is so because the absolute number of pay-offs permanently increases. Other situations, probably more realistic, include a decrease in reciprocal giving. Such a case is modelled in Figure 3.

The assumptions about players and institutions are the same as mentioned above. The only difference is that a received gift does not require a return with an interest. Instead, we assume that a gift can be reciprocated with a discounted gift. In short, players follow the norms of the three obligations, they can, however, return less than they have received. Since the rule now is that fewer valuables can be returned, we assume that in the sequential process also the social costs related to the violation of the obligations decrease with each node. At a final node pay-offs for both players are close or equal to zero. Such a Gift game with discount can have a final node.

Figure 3: Gift Game with Discount



Let us assume that nature N endows player A with 10 units of ‘valuables’ ( $e = 10$ ). Player A has at node one the option to pass the endowment as a gift. The common rule for both players is that a received gift can be returned with a discount. To simplify the example, we assume that the discount is -1 at every node. As a consequence, the game ends at the  $n$ 's node with  $n = e+1$ . With an endowment of 10, player A is the first and last player in the game. In order to illustrate the pay-offs for a ‘take’ decision, let us assume that we are at node three in Figure 3. If A chooses  $t$ , then her utility is -8 and the utility of B is +8. But if A passes and B chooses the ‘take’ option at node four, A has a utility of 7 and B a utility of -7. As one can see, the pay-offs converge to zero the longer the game is played. The best decision for both players still is always to pass until the final node when the gift is fully reciprocated and social costs are zero.

Two questions can be tackled here. Firstly, does such a Gift game with a discount depict social situations? Indeed, the discount on a gift may mirror a social context where social norms to reciprocate are fully in power, however, change occurs and obligations are getting weaker the longer the game is played in a society. Mauss himself provides narratives of such situations that indicate social change that occurs over generations (Mauss, 1990:71-78). Secondly, do players play such a situation until the end? Rational players who avoid social costs would play the game to the end. However, as we have seen from the original Centipede game, some people do not behave rationally in the sense of utility maximizing, they cooperate instead. Thus a hypothesis can read that in the Gift Game with discount some players do not obey obligations but play irrationally. In the specific case it means that they stop the game before the end and accept social costs.<sup>4</sup>

## Conclusion

This note states that concepts and methods developed in behavioural economics can be usefully applied in the field of economic anthropology. In the last 40 years economists have gone much beyond models and theory associated with neoclassical economics. They have formed theories based on institutions (new institutional economics) and those that are related to psychology (behavioural economics) or biology (neuroscience). While neoclassical theory still provides guidance to analyze social context (cf. Carrier, 2014 and the comment by Egbert, 2015), many if not most economists have fully acknowledged that this theory is insufficient to address *all* social contexts.

The neighbouring social sciences have not yet become fully aware of this fundamental change of thinking within economics over the last decades. For instance, some anthropologists still emphasise antagonistic positions between economics and the other

<sup>4</sup> For simplicity reasons it is assumed that the utility of the players does not include the saved discount. It is assumed to be zero.



social sciences and reduce the former largely to neoclassical theory. An example is a leading and generally excellent textbook of Hann and Hart (2011:162) who state that “[T]he project of economics needs to be rescued from the economists”. Such claims are in as much counterproductive to interdisciplinary work as positions held by some economists who do not deal in depth with valuable concepts developed in anthropology.

The objective of this note was to show that even core topics in economic anthropology, such as Marcel Mauss’s *Gift* can be related to models and methodologies used in economics, for instance, in behavioural economics. The case employed in this paper is the model of a Centipede game applied to a gift-giving context.

## References

- Binmore K (2007) *Playing for Real*. Oxford: Oxford University Press.
- Bornstein G, Kugler T, Ziegelmeyer, A (2004) Individual and group decisions in the Centipede Game: Are groups more ‘rational’ players? *Journal of Experimental Social Psychology* 40(5): 599–605.
- Camerer CF (2003) *Behavioral Game Theory*. New York/Princeton: Russell Sage Foundation/Princeton University Press.
- Carrier JG (2014) Economic deviance. *Anthropology Today* 30(6): 1–2.
- Danese M, Mittone L (2015) Norms and trades: An experimental investigation. *Rationality and Society* 27(3): 259–282.
- Douglas M (1990) Introduction. In Marcel Mauss *The Gift: The Form and Reason for Exchange in Archaic Societies* (translated by WD Halls). London: Routledge, pp. 1–7.
- Egbert H (2015) The return of homo oeconomicus to anthropology: Comment on ‘Economic deviance’ by James G Carrier. *Anthropology Today* 31(3): 17.
- Egbert H (2017) The Gift and Pay-What-You-Want Pricing. *Journal of Business Anthropology* (forthcoming).
- Egbert H, Sedlarski T (2016) Marcel Mauss and New Institutional Economics (in Bulgarian). *Economic and Social Alternatives* 2016(4): 121–129.
- Falk A, Fischbacher U (2006) A theory of reciprocity. *Games and Economic Behavior* 54: 293–315.
- Fey M, McKelvey RD, Palfrey TR (1996) An experimental study of constant sum games. *International Journal of Game Theory* 25(3): 269–287.
- Greiner B, Levati MV (2005) Indirect reciprocity in cyclical networks: An experimental study. *Journal of Economic Psychology* 26(5): 711–731.
- Hahn HP, Schmidt M, Seitz E (eds.) (2015) *Marcel Mauss: Schriften zum Geld*. Frankfurt: Suhrkamp.
- Hann C (2006) The gift and reciprocity: Perspectives from economic anthropology. In SC Kolm and J Mercier Ythier (eds.) *Handbook of the Economics of Giving, Altruism and Reciprocity*, pp. 208–369. Amsterdam: Elsevier.
- Hann C, Hart K (2011) *Economic Anthropology*. Cambridge: Polity Press.

- Hart K (2007) Marcel Mauss: In pursuit of the whole. A review essay. *Comparative Studies in Society and History* 49(2): 473–485.
- Henrich J (2000) Does culture matter in economic behaviour? Ultimatum game bargaining among the Machiguenga of Peruvian Amazon. *American Economic Review* 90(4): 973–979.
- Henrich J, Boyd R, Bowles S, Camerer C, Fehr E, Gintis H, McElreath R (2001). In search of homo economicus: Behavioral experiments in 15 small-scale societies. *American Economic Review. Papers and Proceedings* 91(2): 73–78.
- Ho TH, Weigelt K (2005) Trust building among strangers. *Management Science* 51(4): 519–530.
- Kranton RE (1996) Reciprocal exchange: A self-sustaining system. *American Economic Review* 86(4): 830–851.
- Krockow EM, Colman AM, Pulford BD (2016) Exploring cooperation and competition in the Centipede game through verbal protocol analysis. *European Journal of Social Psychology* (forthcoming 2016).
- Liebersohn H (2011) *The Return of the Gift: European History of a Global Idea*. Cambridge: Cambridge University Press.
- Mauss M (1923-1924) Essai sur le don. Forme et raison de l'échange dans les sociétés primitives. *L'Année Sociologique* 1923/24(1): 30-186.
- Mauss M (1990) *The Gift: The Form and Reason for Exchange in Archaic Societies* (translated by WD Halls). London: Routledge.
- McKelvey R, Palfrey T (1992) An experimental study of the centipede game. *Econometrica* 60(4): 803–836.
- Murphy RO, Rapoport A, Parco JE (2004) Population learning of cooperative behaviour in a three-person Centipede Game. *Rationality and Society* 16(1), 91–120.
- Nagel R, Tang FF (1998) Experimental results on the Centipede Game in normal form: An investigation on learning. *Journal of Mathematical Psychology* 42(2-3): 356–384.
- Parco, JE, Rapoport A, Stein WE (2002) Effects of financial incentives on the breakdown of mutual trust. *Psychological Science* 13(3): 292–297.
- Palacios-Huerta I, Volij O (2009) Field centipedes. *American Economic Review* 99(4): 1619–1635.
- Rapoport A, Stein WE, Parco JE, Nicholas TE (2003) Equilibrium play and adaptive learning in a three-person Centipede Game. *Games and Economic Behavior* 43: 239–265.
- Rosenthal R (1981) Games of perfect information, predatory pricing, and the chain store paradox. *Journal of Economic Theory* 25(1): 92–100.
- Thaler RH (1980) Toward a positive theory of consumer choice. *Journal of Economic Behavior and Organization* 1(1): 39–60.