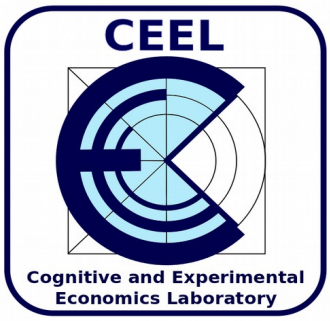

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THE CIRCULATION OF WORTHLESS OBJECTS AIDS COOPERATION.

AN EXPERIMENT INSPIRED BY THE KULA

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Abstract

Many anthropological records exist of apparently worthless objects used in traditional societies, often part of larger institutional arrangements that were instrumental in favoring cooperation and reducing conflict. The most famous examples of such objects are probably the Kula necklaces and armbands first described by B. Malinowski. In our experiment subjects can send a token to another participant before each round of a repeated public good game. We use as tokens a bracelet built by the participants, a piece of cardboard provided by the experimenter, and an object brought from home by the participants. Contributions to the public good in the treatments featuring a bracelet and cardboard are significantly higher than in a control study. The home object was not equally useful in increasing contributions. Notwithstanding the cheap talk nature of the decision to send the token, both sending and receiving the token are associated with a significant increase in contributions.

JEL codes: C92, D01, H40.

Keywords: Kula, worthless objects, cooperation, public goods games, signaling, *kitoum*.

Introduction

Ethnographic research shows that objects of different types[2] help reduce competition and promote cooperation within and among groups. In the circuit of the Kula[3], first described by Bronislaw Malinowski in his classic *Argonauts of the Western Pacific: An account of native enterprise and adventure in the archipelagos of Melanesian New Guinea* (Malinowski 1922 [2014], hereafter AWP), the natives of the area of the Trobriand Islands travel to neighboring islands to exchange ceremonial objects, necklaces or armbands (collectively known as *vaygu'a*, or simply "Kula tokens" in the rest of the paper*)*, with their partners located on those islands. The journeys, regulated by a strict etiquette detailed in Malinowski's book, were also the occasion to barter (*gimwali*) more lowly commodities such as pigs and canoes, and arrange inter-island marriages. During expeditions east, the natives donated the necklaces, receiving armbands. During expeditions west, they donated armbands, receiving back necklaces (AWP, p. 100). The two object types thus flowed in a "circle," but in opposite directions, the necklaces clockwise and the armbands counter-clockwise.

In this paper, we study in the lab whether participants achieve higher-than-expected levels of cooperation in the provision of a public good thanks to the exchange of seemingly worthless objects, such as in the Kula. In our experiment, subjects can send before every round of a repeated public goods game (PGG) a token, either a bracelet the participants built at the beginning of the experiment, or a piece of cardboard we provided to each participant or a small object that participants brought from home. Each participant might also receive a token (bracelet, cardboard or object brought from home) from another participant in his/her group, before each

[2] Cf. e.g., Feil (1987), conducting work in Papua New Guinea and documenting objects such as animals and trees serving this function.

[3] The Kula has been described as the "best-documented example of a non-Western, preindustrial, non-monetized, translocal exchange system" (Appadurai, 1986, p. 18).

round of the PGG. Our primary hypothesis is that exchanging these objects increases cooperation above expected levels from a control study. Receiving the token is a signal[4] that the sender might have "kind intentions," an attitude that might result in higher contributions in the ensuing PGG. Receiving the token does not provide, however, conclusive evidence about the results of the ensuing strategic interaction. The token did not bind the sender's, nor the recipient's, choices in the PGG, and therefore we are in the presence of a "cheap token," a nonverbal version of a "cheap talk" verbal signal. Furthermore, each player only receives a local signal from the sender of the token, while no signal is received from the other players in each group.

We found that both sending and receiving the token are associated with a higher, but modest in magnitude, propensity to contribute to the public good. In the majority of cases, the participants injected the good into the circuit, showing that they were typically willing to initiate the trade. The bracelet and the cardboard studies feature the highest contributions. The home object did not increase contributions significantly compared to the control.

The Kula: the bond between objects and people

[4] There is a rich literature in economics on signaling as a way to convey information about one's "type," information that is otherwise unobservable by the counterpart. Cf. Jehle & Reny (2011, p. 385) for a presentation of these models. Cf. also the evolutionary game-theory model of costly signaling due to Gintis et al. (2001), showing that signals may, under some parameter choices, spread and be an evolutionary-stable strategy. In our study, each player might be of several types, cooperative or uncooperative, and all shades in between, in the PGG. Sending the signal was costly, as it deprived the sender of the possibility to send one in the future unless another player sent him/her a token. Sending the token, therefore, should provide to the receiver valuable information on the sender's type. This conclusion is, however, complicated by the fact that signals are typically "noisy" in public good games: even after sending the token, the sender has an incentive to free ride, the dominant strategy in the finitely-repeated PGG. The signal might provide help in formulating a strategy in the repeated game. An attractive strategy in the repeated prisoners' dilemma is tit-for-tat, i.e., responding to the behavior of the opponent in the previous period. In our case, the player might contribute more if a token was received, and less if none was received. We confirm that many subjects used this strategy by establishing a significant link between receiving a token and increased contributions.

A long-standing question in the social sciences is what was the function of the Kula objects[5]. The necklaces and armbands exchanged in the Kula voyages were made of materials that were "freely, though by no means, easily" available in the area of the Trobriand (AWP, p. 375). These materials were seashells that the Islanders could procure according to ceremonial and socially sanctioned protocols. Everyone, including the commoners, could fish for these shells and build a Kula object. This was particularly the case in the districts that were famous as assembly points of the objects themselves. The objects were rarely worn, according to Malinowski, and therefore they did not serve any practical or ornamental purpose. The feature of the Kula objects that the Islanders seemed to value the most was their quality of being *old* and having been possessed by famed individuals (cf. Munn, 1986, p. 114, and Weiner, 1983, p. 163). The Kula objects had names, which made it possible to target specific objects during the trades, those thought to be the oldest ones. Many anthropologists have reported that a native would engage in the Kula to establish his reputation and build fame[6] as a trusted partner for the Kula trade as well as for the barter of other commodities[7]. Considering that all objects were made of the same materials (shells) and that the objects were rarely worn, the "fame" mechanism appears to be an ingenious way to introduce a degree of heterogeneity, and scarcity, into an otherwise highly homogenous commodity. When we refer to the Kula objects as "worthless," we, therefore, use a very narrow understanding of the term "worth," related to the scarcity (or lack thereof, in this case) of the materials used. If one looks at the effort that went into "courting" the owners of the oldest

[5] Cf. Danese & Mittone (2017) for references.

[6] Cf. Munn (1986, p. 287) quoting an islander from the island of Gava saying that "When you are given a Kula shell, your name is spoken; people come to know your name. You climb (*ku-mwena*)." Also, Landa (1994, p. 166) discussing the "name spreading function" of the Kula in a society that featured no writing and, hence, no possibility of a written record of someone's ranking in society.

[7] Although Malinowski reported that the ceremonial aspect of the exchange (Kula) and barter (*gimwali)* did not "mix," later scholarship has found that the possessors could also use Kula tokens to leverage their position in *gimwali* barters (i.e. to secure yams, land, and women, cf. Campbell, 1983, p. 204).

objects, or the labor time that went into fishing the shells, one can indeed conclude that the objects had "value."[8]

The Kula creates obligations to repay objects received with objects of equivalent value, or with intermediary gifts until such objects became available, keeping relationships among the islanders alive in frequent gives and takes along the path (*keda*) of the objects (Mauss, 1954)[9]. This arrangement, lacking any external enforcement mechanism sanctioning the keeping of the tokens for too long, seems fragile to the eyes of a current market participant. To complicate matters, the Kula participants did not engage in exchanges of similar objects (i.e., necklaces for necklaces, and armbands for armbands). An object would return to the original donor only after having gone through its *keda.* The Kula was, in fact, based on *indirect* reciprocation (cf. Alexander, 1987).

Several institutional features of the Kula reinforced the prohibition against keeping the tokens for too long, which would have brought the institution to an impasse. According to some scholars (Weiner, 1983; Damon, 1980; Munn, 1986) some objects in the Kula are *kitoum* (also spelled *kitomu* or *kitom*). The objects were initially owned, in a "despotic" fashion, by someone.[10] The owner could have been the person who had initially assembled the object, or someone who had purchased it from the producer in exchange for yams, pigs or other products (Weiner, 1983). A *kitoum* "travels on a Kula path (*keda*), but throughout its circulation, the token is known to belong to one person. When the object reaches its destination, the individual to

[8] Cf. on the vexed question of the "value" of the Kula objects the considerations in Danese & Mittone (2017, pp. 242-243).

[9] Malmendier & Schmidt (2017) find evidence that gifts are given in a three-player (two "producers", one "customer") experimental game, and these gifts create obligations to repay. Customers typically favor the producer who gives the gift and discriminate against producers who do not give gifts.

[10] In William Blackstone's famous words, ownership is "that sole and despotic dominion which one man claims and exercises over the external things of the world, in total exclusion of the right of any other individual in the universe (Blackstone, 2001 [1763], Vol. II, p. 3).

whom it pertains may use it at his own discretion" (Weiner, 1983, p. 148). Weiner (1983, p. 161) reports that on Kiriwina, the island visited by Malinowski, the natives could procure *kitoum* in a nearby island (Kaleuna) where armbands were produced. If it is true that many objects exhibit the quality of being someone's *kitoum*, then this reinforces the continuous give-and-take aspect of the Kula. If the original owner renounced ownership, no one was to lay permanent claim to it. Also, the indirect reciprocity aspect of the Kula was probably key to its duration. It took many years until objects finally returned to the original owner. Had exchanges been in kind, a necklace for a necklace and an armband for an armband, the net effect of the inter-temporal relationships would have been nil.

Taking a bird's eye view, the institution of the Kula shares some features with a public good[11] (Bergstrom, Blume, & Varian, 1986; Andreoni, 1988), hence the choice of the PGG in our experiment. Provided one could procure a ceremonial object, he could travel to other islands. It was hard, therefore, to exclude people from taking part in the Kula. The *keda* of the Kula tokens guaranteed to the travelers a degree of safety in their journeys (cf. Campbell, 1983, p. 205). The *keda* also guarantees something that is similar to an indefinite duration for the exchanges, expanding the set of equilibrium strategies in the "game" played by the Kula participants. Safety and an indefinite horizon for exchanges are not rival commodities, for they can be enjoyed by all Kula participants and even by the non-participants in the form of reduced animosity among the inhabitants of the different islands. The closest example of public good to the Kula is, probably, national defense. One might add that, while the Kula as an institution might resemble a public good, the Kula objects were rival and, for a period, the temporary owner could exclude others from owning his object.

[11] Cf. Landa (1994, p. 166): "the public good in question in the Kula Ring is law and order."

Related experimental literature

Our experiment is related to the literature on signaling in public good games and to the literature on nonverbal signals in strategic interactions (not only social dilemma-type of interactions). Signaling in public good games has mostly taken the form of "cheap talk" (cf. Crawford, 1998, and the references cited therein). Several studies found that cheap talk increases cooperation in public goods games (cf. Ledyard, 1995, pp. 156-158 and references cited therein). Wilson & Sell (1997) found that cheap talk alone might have little effect on contributions and that coupling cheap talk with information about past behavior of the opponent might work better than each manipulation on its own. Palfrey & Rosenthal (1991) found that players condition heavily on the signals they receive in a PGG.

Kurzban (2001) found that nonverbal communication can aid cooperation among males in a PGG. The types of nonverbal communication studied in the paper were mutual eye gaze (ineffective for both sexes), touch on the shoulder (marginally impacting the contribution behavior of males but not of females), tap out on a rhythm (ineffective for both sexes), and messages unrelated to the game sent via computer (positively associated with contributions in males but not in groups of females)[12]. The structure of Kurzban's experiment is the same we use in our experiment, i.e., nonverbal cues were sent before each round of the PGG.

Camera, Casari, & Bigoni (2013), CCB henceforth, study the role of worthless objects in sustaining trust among strangers in groups of different sizes. Participants were always involved in two-player interactions, but the pool from which the opponent was picked varied from a

[12] Brook & Servátka (2016) give "recipients" the possibility to send emoticons to their "dictators", finding that the emoticons are often used and effective in discouraging selfish behavior.

singleton (so always the same two players interacted) to 32. In some of the sessions, participants could voluntarily award a worthless token to their opponent, who was involved in a "helping" game. These tokens became something similar to fiat money, an institution that favored cooperation in large groups, but "crowded out" norms of voluntary provision of help, as participants came to demand tokens in exchange for help.

Our study takes a different stance regarding the function of tokens: while in CCB participants might receive a token if they helped the other participant, in our study participants might send tokens to change the beliefs about the outcomes of an ensuing strategic interaction. Whether in the circuit of the Kula the tokens were a form of money[13], and whether they were donated as a recognition of one's help, as in CCB's approach, or as a signal of one's willingness to trade, as in our paper, are questions that are hard to settle given available evidence. Considering that the Kula is an indefinitely repeated game, all such dimensions likely play a role.

The next section presents our experimental design.

Experimental design

Our treatment studies (*bracelet*, *cardboard*, and *home object*) are modified, repeated public good games. 6 players interacted for an undisclosed number of rounds (the game stopped at the end of the 12th round in all our experiments), to avoid end-game effects. In all sessions, there were 12 or 18 participants in the experimental room, to maintain the anonymity of the group

[13] Mauss (1954, p. 71) noticed that the *vaygu'a* were "at once wealth, tokens of wealth, means of exchange and payment, and things to be given away or destroyed" (p. 71), and hence should be put in the same "genus" as money (p. 94). He noticed that in Germanic languages the words *token* and *Zeichen* both designate money. He criticised Malinowski (AWP, p. 528) for objecting to the use of the term "money" for the Kula tokens. According to Mauss, Malinowski adopted a "narrow" notion of money, as storage of value backed by an external institution, which is only applicable to modern societies (p. 94).

participants. The choice of the number of players (6) and rounds (12) makes it possible to receive back, possibly even twice, the object one originally "injected" into the circuit.

In part 1 of the study *bracelet*, subjects were randomly assigned to a computer in the experimental room, and given a code with a letter and number. Letters (A, B or C) identified the group the participant belonged to, while the numbers (from 1 to 6) their ID in each group. The experimenter read the instructions (available upon request for all studies from the corresponding author). The instructions did not make any reference to the public good as a common project or good that would benefit all (as in the *cooperative* condition of Cone & Rand, 2014). The instructions simply stated that the players could choose how much to consume of two goods, one that benefitted them linearly, and one whose fruition depended on the other players' choices. The instructions are closer to those used in Cone & Rand's *competitive* condition, which also referred to the possibility to either keep the money for oneself or to "contribute."

Subjects then completed a comprehension test that was individually checked by the experimenter. Questions were privately answered. Subjects were then asked to build a bracelet using beads and a string provided on each desk. The number of beads given to each participant was approximately 25, and subjects were told they could use any number of beads for their bracelet. Subjects were given a maximum of 10 minutes to build the bracelet. Figure 1 shows a bracelet that was left behind by one of the participants. The choice of the bracelet is obviously inspired by one of the Kula objects, the "armband" (or "armshell" as Malinowski referred to it). We chose to ask the participants to build a bracelet, instead of a necklace (the other Kula token) because bracelets are smaller and easier to assemble.

Figure 1: a bracelet built by one of the participants

Part 2 of the experiment then started. Participants decided whether they wished to send the bracelet they had built in Part 1 to another member of their group. The path of the bracelets, just like the *keda* of the Kula tokens, was fixed. Player A6 always sent the bracelet to A1, A1 to A2, and so on. In our experiment, there was no possibility of direct reciprocation between two players: the reciprocation is, instead, indirect, as in the Kula. Each participant inserted the bracelet in a small tube that had two compartments. The tubes were two film canisters glued together, with the two extremes of the tube closed by the canister lids. Subjects were instructed to insert if they wished the bracelet into the tube using the side which had been marked with a sticker. The other side of the tube contained a small piece of wood with the experimental ID of each participant. Confederates collected the tubes and brought them to the experimenter. The experimenter manually checked whether each player had sent the bracelet or not, and then replaced each sender's code with the recipient's code. For example, the code of player A2 was replaced with A3. A confederate then brought the tube to player A3, and so on for all other participants. Participants were aware that the tubes were delivered regardless of whether there

was a bracelet inside or not. The, somewhat cumbersome and time-consuming, procedure of checking the tubes one-by-one was dictated by the desire to avoid the participants self-reporting whether they had received, or sent, the bracelet. In particular, some participants might have inaccurately reported having sent the bracelet to "save face."

After the tubes had been delivered, Part 3 of the experiment started. Subjects decided how many points, out of 10, to allocate to a public good. As soon as all players confirmed their choice, each player was shown again his/her contribution, the sum of all group members' contributions to the public good (not each single opponent's contribution), one's share of earnings from the public good, and one's current-period earnings. Part 2 and 3 of the game, the bracelet sending/receiving and the contribution choice to the public good, were repeated in sequence for 12 times. After the game ended, participants completed a debriefing questionnaire. Then subjects were paid their earnings privately. Participants were instructed that all bracelets in their possession by the end of the experiment were their property, or they could leave the bracelet(s) in the lab.

The final payoff was the sum of the payoff in each round of the PGG. The payoff in each round is shown in equation (1).

$$\pi_{it} = s_{it} + \frac{2.4}{6}\sum_{i=1,t}^{6} r_{it} \quad (1)$$

s_{it} is the investment in the private good of player *i* in round *t*; 2.4 is the multiplier, 6 the number of players in each group; r_{it} the contribution of each group member to the public good in round *t*, with $s_{it} + r_{it} = e_{it}$, where $e_{it} = 10$, the period endowment. The exchange rate was set at 5 euro cents per experimental point, plus a 3-euro show-up fee. To this monetary payoff, one could add the value of the bracelet(s). If one looks only at the value of the raw materials (beads and string),

the value of the bracelet did not exceed a few euro cents. Only a handful of players left the bracelets behind, a sign that most players thought it worthwhile to bring the bracelet with them.

In the study *cardboard*, subjects completed Part 1, the construction of the bracelet. Bracelets were then collected, placed in an envelope with the participant's experimental ID, and kept in storage by the experimenter. Participants knew from the instructions that the bracelet would be returned to them at the end of the experiment. In part 2, participants could send through the usual tube a piece of cardboard with a simple marking (a circle, or a line, square) to the next player. The piece of cardboard was placed on each desk before the start of the experiment. Confederates collected the tubes and brought them to the experimenter, who registered whether the player had sent the cardboard piece or not, and delivered the tubes to their recipients. Part 3 then started, the PGG. Part 2 and three were repeated a total of 12 times, undisclosed as usual to the participants. Subjects completed a questionnaire and were then paid their earnings, and given back their bracelets. Subjects were instructed that they could keep the pieces of cardboard or leave them behind. Unsurprisingly, virtually all subjects left the pieces of cardboard in the lab.

In the *home object* study the participants, upon receiving a reminder email the day before the experiment, were asked to bring a small object with them that would fit a small tube. Subjects were given some examples of acceptable objects, such as an elastic band, a button, a piece of paper, an eraser. Subjects were also warned that they might have lost the object in the course of the experiment. On the day of the experiment, we verified in private that the subjects had brought the object. The subjects were then seated in the experimental room. Part 1 then ensued (instructions and bracelet building). Bracelets were collected by the experimenter. In part 2, the subjects decided whether to send to the next player the object they had brought from home, through the usual tube. As usual, the experimenter recorded whether the object was sent or not,

and then the objects were delivered. Samples of objects that were sent were erasers, pieces of paper, candies, and elastic bands. Part 3, the PGG, followed part 2. As usual, the number of rounds was 12. The questionnaire, payment and the return of the bracelets concluded the experiment. Participants were told that they could bring the objects in their possession home. Most subjects brought the objects home.

As we explain further in the next section, we used different types of objects, bracelets, cardboards and an object brought from home, to artificially create different degrees of proximity between the objects and the participants, who remain anonymous through the game. We hypothesize that the objects that have a link to the participants, the bracelets, and the home objects, should convey more information than the cardboard about strategies to be played in the ensuing PGG.

In the *control* study, subjects completed Part 1 (instructions and bracelet construction). The experimenter collected the bracelets. Participants played the repeated Public Good Game (Part 3 of the treatment) for an undisclosed number of rounds (12 in all sessions). The experiment ended with the administration of the questionnaire, followed by the payment and the return of the bracelets. In the control study, there was no object circulating before each round of the PGG.

In the study *control with delay*, subjects in Part 3 (the PGG) had 2 minutes to decide how much to contribute to the public good in each round. During this period, the subjects could change their mind. At the end of the 2 minutes an OK button appeared, and subjects confirmed their choices. After everyone had confirmed his/her choice, the usual feedback was provided, and a new round started. The control with delay was otherwise equivalent to the control.

The control with delay, as we explain further below, was needed to replicate the time lags of the treatment studies, where some time was required to collect the tubes, record their contents, and deliver them to the recipients.

In conclusion, all our studies (treatments and controls) featured a bracelet-construction stage (Part 1) and a repeated PGG (Part 3). In the *bracelet*, *cardboard*, and *home object* studies, Part 3 is preceded by Part 2, namely the decision whether to send a token or not. The decision to let participants construct the bracelet in all our studies was dictated by the desire to ensure comparability of the results from the different studies. We do not believe, in fact, that the construction of the bracelets had any effect per se on PGG behavior. As we further discuss in the next section, we hypothesize that any behavioral difference between the treatments and the controls comes from the *circulation* of the tokens.

Hypotheses

We formulate four testable hypotheses. The first is a basic hypothesis about the effectiveness of our manipulations.

H1. Contributions are higher in all treatments than in the control.

The second hypothesis is about the relationship between "token behavior" and PGG behavior.

H2. Sending, and receiving, the token is associated with higher contributions to the public good in the treatments (bracelet, cardboard and home object).

This is due, as we have discussed earlier, to the information content of the tokens, which might reveal an increased willingness to contribute to the public good. Subjects might also increase contributions conditional upon receiving a token.

The third hypothesis is about the comparative effectiveness of the different tokens in promoting cooperation.

H3. The home object and bracelet are more effective in increasing contributions than the cardboard piece.

In the impossibility to associate objects to "famed" individuals in the lab and to generate stories for the different objects, we looked for alternative ways to create a bond between the objects and the participants in our experiment. The bracelet was an artisanal piece built through an actual exercise of effort by each participant. Some effort was also involved in bringing the home objects to the lab room. The participants might have recognized the *kitoum* aspect of these two objects, i.e., the original owner's willingness to part with the bracelet or the home object for the sake of the group. The bracelet and the home object continue being signals of good intentions as the objects travel around, and it becomes impossible to know whose object one is sending or receiving. The impossibility to trace objects back to the original owner happens because, unlike in the Kula, the tokens had no name. The signaling aspect and the *kitoum* aspect are, therefore, both bundled together in the decision to send the token at the beginning of the experiment. In later rounds, the signaling aspect becomes instead predominant.

The piece of cardboard is unassuming, and it was not produced by the participants. The signaling aspect is, however, intact. The cardboard is comparable to sending messages in a cheap

talk experiment, where a payoff-irrelevant "verbal object" is sent. Cheap talk experiments are advantageous in allowing the experimenter to associate labels that will be recognized by all participants to the messages, e.g., "I will cooperate." In the case of the cardboard, the "common language aspect" might be more complicated and the participants might have been wondering what the use of these objects was. The "kindness" of one's decision to send the cardboard should, however, be apparent.

We also formulate a hypothesis regarding the effect of time on contributions.

H4. Delay in the studies with a token and the control study with delay is associated with lower contributions.

In the studies with a token, there was a lapse of 1 to 2 minutes between the time subjects sent the tube and the time they received another tube back. Subjects could in the meanwhile ruminate on their contribution choices. In the control study, instead, because no token was exchanged, subjects moved from one round to the next as soon as everyone had confirmed his/her choice, and everyone had pressed the OK button in the feedback screen. Cone & Rand (2014) survey literature that finds that, under time pressure, the heuristics that subjects are likely to use favors the "cooperative" decision, leading to higher contributions in the PGG. In their study of one-shot PGGs, the authors find that time pressure is associated with higher contributions when the instructions do not refer to the public good as a joint project, as in our study. The most natural hypothesis for our study is, then, that the delay induced by the collection and the return of the tubes pushes contributions down, countering the positive effect of the token exchange on

contributions in the treatment studies. Cone & Rand's is, however, a one-shot experiment. In a repeated design like ours, the decisions of the players are likely affected by learning, by social norms of fairness and reciprocity related to the other players' contributions, and by the history of exchanges of the tokens. Furthermore, Cone & Rand induced time delay by asking participants to ponder their choice carefully. No such manipulation occurred in our study. The effect of delay on contribution behavior in our study might, therefore, be smaller than the literature has found.

Data analysis

We recruited 198 subjects through an email announcement sent to University of Trento students who were registered on the website of the Cognitive and Experimental Economics Laboratory of the University of Trento (CEEL). All experiments took place at the dedicated lab facilities of CEEL. No student took part more than once in any of our experiments. 24 subjects (4 groups) participated in the *control* study, 36 subjects (6 groups) in our *control with delay* study, 54 (9 groups) in our *bracelet* study, 54 (9 groups) in our *cardboard* study, 30 (5 groups) in our *home object* study. The sample was roughly gender balanced.

Summary statistics

Table 1 shows the descriptive statistics for all our treatments and controls. As expected, subjects spent most of their resources in the private good. The variable *return*, calculated as the difference between the share of the public good received and the amount invested in the public good, shows that subjects have, on average, earned a positive return through their decisions to invest in the public good. In about 40% of the cases the token was sent (and hence received). Not

shown in Table 1, in 76% of the cases, the token (cardboard, bracelet or home object) has been sent in round 1.

Table 1: descriptive statistics for each study

1a. Control study

Variable	**Obs**	**Mean**	**Std. Dev.**	**Min**	**Max**
privategood	288	6.78	3.57	0	10
contPG	288	3.22	3.56	0	10
payoff	288	14.51	3.86	4.8	24.4
return	288	4.51	3.86	-5.2	14.4

1b. Control with delay study

Variable	**Obs**	**Mean**	**Std. Dev.**	**Min**	**Max**
privategood	432	7.16	2.80	0	10
contPG	432	2.83	2.80	0	10
payoff	432	13.97	3.08	5.4	23.6
return	432	3.97	3.08	-4.6	13.6

1c. Bracelet study

Variable	**Obs**	**Mean**	**Std. Dev.**	**Min**	**Max**
privategood	648	6.61	3.3	0	10
contPG	648	3.39	3.3	0	10
payoff	648	14.73	3.74	4	25.2
return	648	4.73	3.74	-6	15.2
tokensent	645[14]	0.39	0.49	0	1
tokenreceived	645	0.39	0.49	0	1

1d. Cardboard study

Variable	**Obs**	**Mean**	**Std. Dev.**	**Min**	**Max**
privategood	648	5.74	3.91	0	10
contPG	648	4.26	3.91	0	10
payoff	648	15.97	4.7	4	29.6
return	648	5.97	4.7	-6	19.6
tokensent	647[15]	0.31	0.46	0	1
tokenreceived	647	0.31	0.46	0	1

[14] In three cases, we failed to record whether the token was sent or not.

[15] In one case, we failed to record whether the token was sent or not.

1e. Home object study

Variable	Obs	Mean	Std. Dev.	Min	Max
privategood	360	7.02	2.75	0	10
contPG	360	2.98	2.75	0	10
payoff	360	14.17	3.08	5.6	24
return	360	4.17	3.08	-4.4	14
tokensent	360	0.52	0.5	0	1
tokenreceived	360	0.52	0.5	0	1

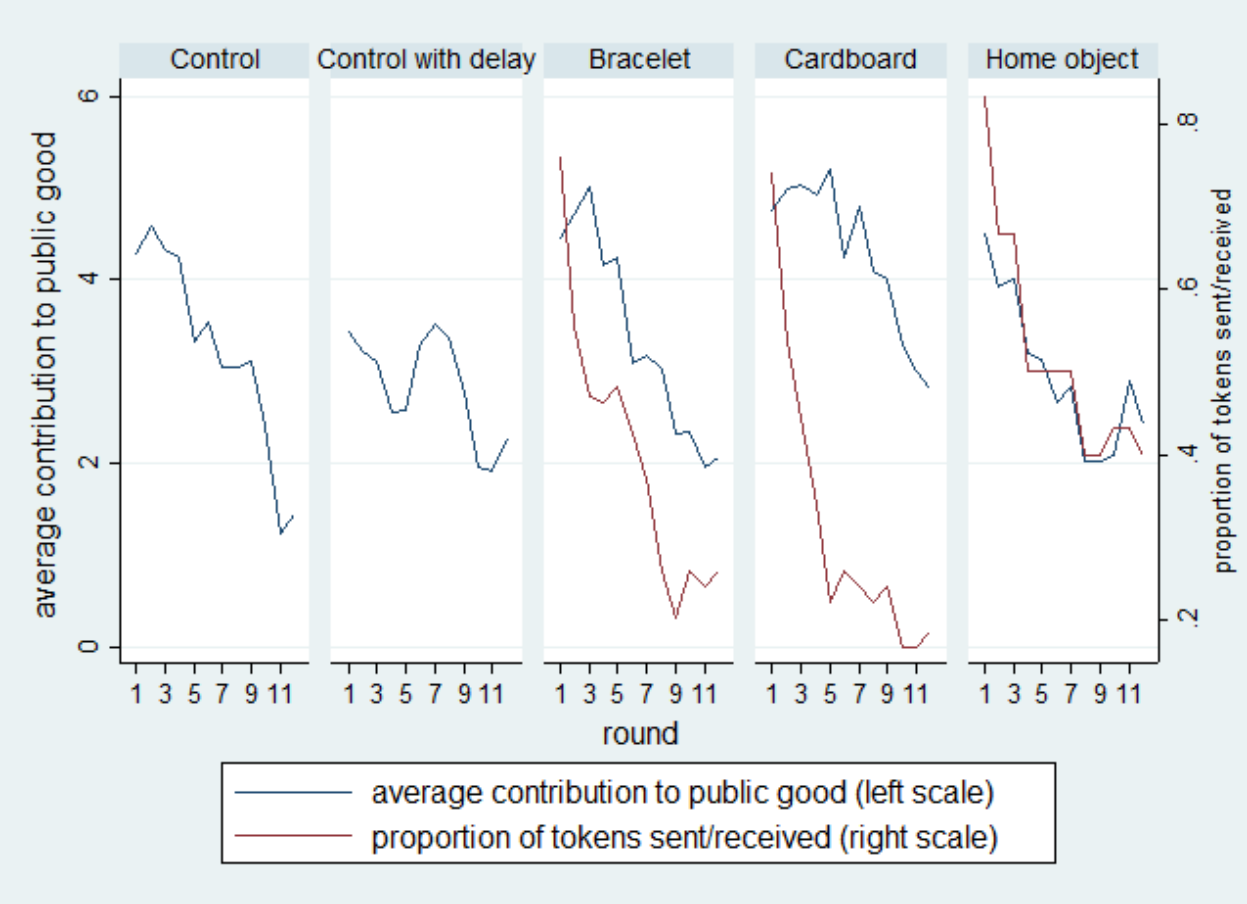
Table 1 shows that contributions to the public good (and hence the payoff, which excludes the show up fee) are highest in the cardboard study. The contributions are lowest in the home object study and the control with delay study. Contributions in the control and bracelet studies appear close. A two-sample Wilcoxon rank-sum (Mann-Whitney[16]) test on the equality of the median contributions in the control studies and all the treatments studies (*bracelet*, *cardboard*, and *home object*) rejects the null hypothesis (p less than 0.01). A nonparametric Jonckheere-Terpstra test finds that going from the controls to the treatments (with a token) is associated with increasing contributions (p less than 0.01). It is apparent that our manipulations affected the main variable of interest, as per Hypothesis 1. Contributions are the lowest in the control with delay study, where the presence of delay as well as the absence of any token circulating might have resulted in comparatively low contributions—a conclusion not supported by the panel data analysis presented later.

[16] Across all studies, the distribution of the contribution to the public good is asymmetric, with a spike at 0. A Shapiro-Wilk's test rejects the null hypothesis of normality for all studies.

Table 1 shows that the study where the tokens were sent less was the cardboard study, i.e., the one study that features the highest contributions to the public good. Perhaps surprisingly, the tokens circulated the most (above half of the times) in the home object study, i.e., the treatment study where contributions were the lowest.

Figure 2 shows the contributions to the public good in each round and the proportion of tokens that were sent (and hence received) in each round.

Figure 2: contributions to the public good and proportion of tokens sent/received, in each round.



In all treatments and controls, a decreasing trend in contributions to the public good is visible, accompanied by occasional attempts to revive contributions. A marked attempt to "boost" contributions occurred around round 5 of our control with delay study[17]. The downward trend in contributions is consistent with many previous studies of PGG (cf. Ledyard, 1995), and the circulation of the tokens was not able to counteract this robust trend in public good games[18].

Regarding the tokens, it is clear that by round 5 cardboard pieces were not circulating anymore, while the home objects continued to circulate until the end of the experiment in large amounts. Upon visual inspection, the paths of contributions to the public good and the path of tokens look similar. Panel data analysis presented later will help establish a statistical link between the decision to send and the event of receiving a token, and the contribution choices of the players.

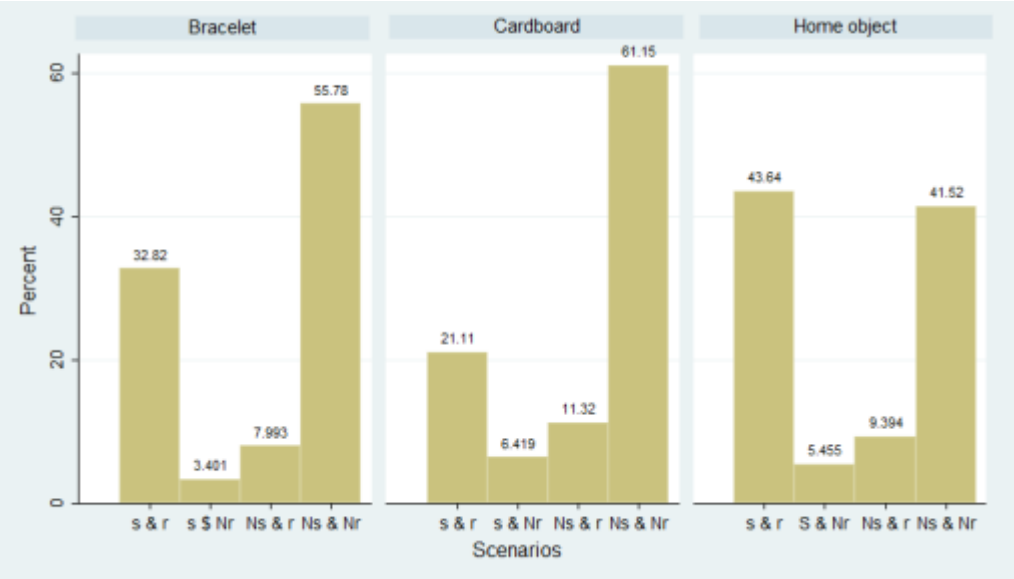
Figure 3 shows four possible scenarios for the tokens. The token might have been sent at round *t*, and one was received at *t-1* (scenario s & r). The player was therefore in a position to send a token at time *t*, and he/she did so. The token might have been sent at *t*, but none was received at *t-1* (*s & Nr*). In this case, the player sent a token which was previously "stocked," i.e., not sent. The token might not have been sent at round *t*, but one was received at *t-1* (*Ns & R*). In this case, a stocking choice occurred. Finally, the token might not have been received at *t-1* and

[17] Several papers have studied the possible causes of such "restart effects" in public good games. Cf. e.g. Klumpp (2012) in this journal and Arifovic & Ledyard (2012).

[18] A simple linear regression of contributions on the round number finds a significant negative trend in all controls and treatments. Contributions fall on average faster in the control and bracelet studies (coefficient estimate=-0.28), followed by the cardboard (-0.20), home object (-0.19) and control with delay (-0.10) studies.

might not have been sent at *t* (*Ns & Nr*). This last case could potentially hide an impossibility to send a token if the subject had not stocked any in the past, a question we investigate next.

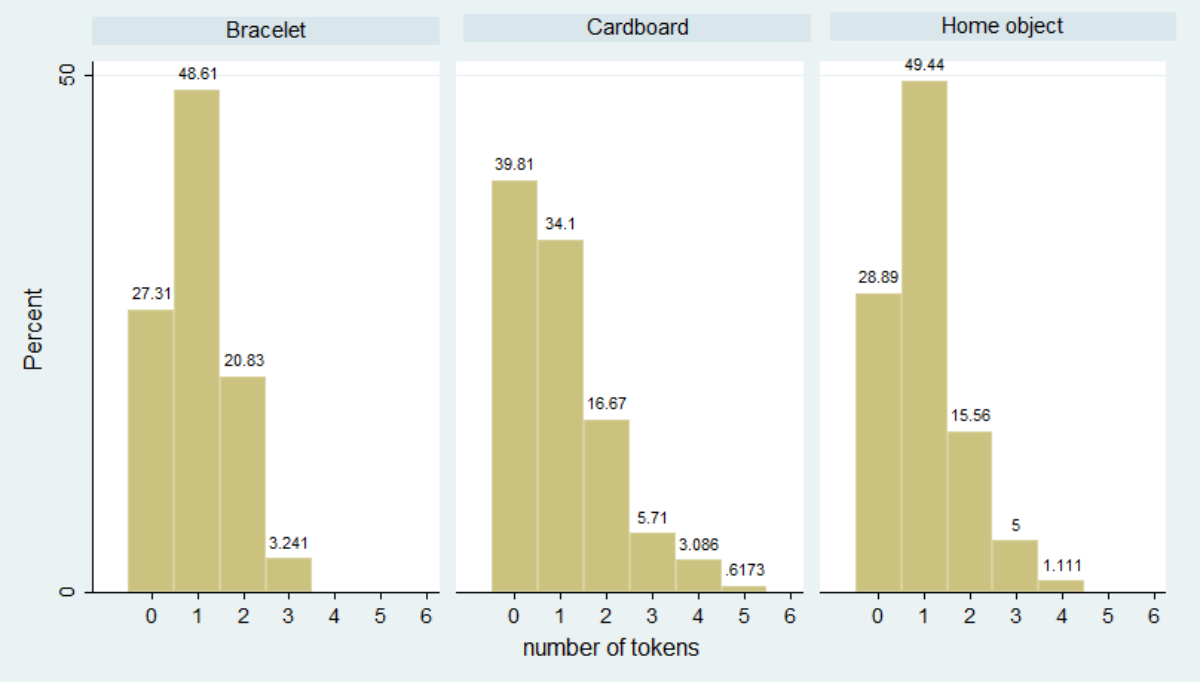
Figure 3: four scenarios for the tokens



Across all the studies, a typical scenario was one in which no token was received in the previous period, and no token was sent (*Ns & Nr*). Given that no direct reciprocation occurred between the players, this behavior cannot be the result of a desire to punish the sender of the token for his/her lack of kindness. A plausible explanation is that the participants had no token available, and therefore could not send one. Another possible explanation is that a token was available, but the participant chose not to send it in that particular round, perhaps to use it later. In the home object study objects were instead most often received and sent.

Figure 4 shows the number of tokens that participants had available, before playing the PGG.

Figure 4: the number of tokens available



In all studies, on average subjects had at least one token available. In the cardboard study having no token at all was the mode, a sign that there was a group of people who likely stocked up the tokens (cf. also Figure 3 showing that in about 11% of the cases a stocking up choice occurred in the cardboard study). Having no object at all took place at approximately the same frequency in the home object and bracelet study. Figure 5 shows the proportion of participants who were "illiquid," a term we borrow from CCB. These participants had no token available at the end of round *t* (i.e., none was received in period *t*, and no stocked token was available), and could not, therefore, send a token in round *t+1*.

Figure 5: the proportion of illiquid participants in each round

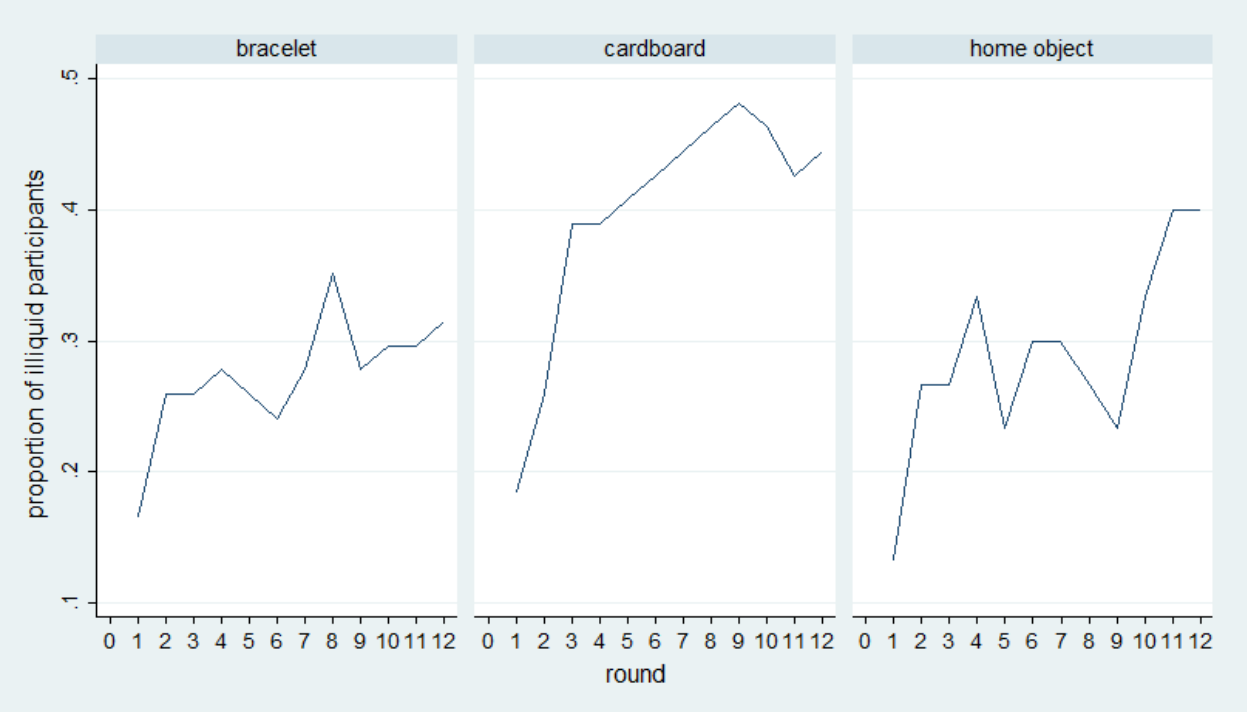


Figure 5 shows, again, that illiquidity was indeed a problem in the cardboard study. In general, an upward trend is apparent in all three studies, showing that more and more participants became “illiquid.” The stockpiling of the cardboard pieces is indeed puzzling. Some subjects might have thought that these objects might have been useful in a hypothetical future stage of the game, and therefore retained the cardboard pieces as a “storage of value," one of the typical functions of money (cf. note 13).

Regression analysis

We have a strongly balanced panel with 198 participants observed over 12 periods. The individual identifier of the panel is the participant, and the time identifier the round. In model 1 we wish to quantify by how much receiving or sending the token increases contributions to the

public good. For this analysis, only the data from the treatments are used, and therefore the cardinality of the personal identifiers is 138. We regress contributions of player *i* to the public good in round *t* on a dummy equal to 1 when player *i* sent the token in round *t*; a dummy equal to 1 when player *i* received the token at round *t*. Both sending and receiving occurred *before* the subjects chose how much to contribute to the PGG[19]. An interaction term between the two sending and receiving dummies; the total amount contributed to the public good by all other members of player *i*'s group in round *t-1*. The information about the other players' contributions was shown at the end of period *t-1* and was hence "available" when deciding about contribution in round *t*, together with the information about having sent and received the bracelet at round *t* (and in previous rounds). The data generating process is shown in equation (2).

$$contPG_{it} = \alpha_i + \beta_1 d_{it}^{toksent} + \beta_2 d_{it}^{tokrcvd} + \beta_3 \left(d_{it}^{toksent} \times d_{it}^{tokrcvd}\right) + \\ + \beta_4 \left(contPG_{it}^{-i,t-1}\right) + \epsilon_{it} \qquad (2)$$

The α_i is a participant-specific, time-invariant effect. If one adds the additional strict exogeneity assumptions that α_i and the error term ϵ_{it} are i.i.d., we have the Random Effects (RE) model (Cameron and Trivedi, 2005, p. 700). An alternative specification of the DGP is the so-called Fixed Effects (FE) model. This model estimates a transformed equation 2 without α_i (cf. Cameron and Trivedi, 2005, p.750). If the model (2) is correctly specified and the exogeneity assumption holds, RE is both consistent and asymptotically efficient. The FE estimates are always consistent, although FE might not be the most efficient estimator due to the

[19] This way of defining the dummy variables does not differentiate between the cases in which a token was available to be sent and was *not* sent, and the case in which a token was not available, and therefore it *could not* be sent. The receiver of the token could not differentiate between these two cases, but only observed whether the token was received or not.

transformation it entails (cf. Cameron and Trivedi, 2005, p.716-17). We estimate the coefficients of interest ($\beta_1, \beta_2, \beta_3, \beta_4$) through both RE and FE. The regression output is shown in Table 2.

Table 2: estimating the impact of sending/receiving the token and past behavior on contributions

Coefficient	**RE**	**FE**
$\hat{\beta}_1$	0.3404*	0.3730*
$\hat{\beta}_2$	0.2635	0.2980*
$\hat{\beta}_3$	0.0175	-0.0127
$\hat{\beta}_4$	0.1078***	0.0961***
constant	(omitted)	(omitted)

* p<0.05; ** p<0.01; *** p<0.001.

p-values always calculated using clustered standard errors at the level of the group of participants interacting for the entire session.

Both models are overall statistically significant. A standard Hausman test fails to find systematic differences in the two sets of estimates (RE and FE models estimated with *default* standard errors for the purposes of running the Hausman test, p-value = 0.104). Sending the token increases significantly contributions, by about a third of a point (out of ten). Sending the token is, hence, on average, a reliable signal of the player's increased willingness to contribute, compared to a baseline level of cooperation. Also receiving the token has a small impact on contributions, significant using FE estimation and marginally insignificant using RE. We find evidence that the players react to receiving the token through a tit-for-tat type of strategy: if the player received the token, this acts, again, as a trigger that increases contributions above a baseline. We find evidence in favor of Hypothesis 2.

Higher contributions to the public good by the other group members in the previous round are associated with higher contributions in the current round. Subjects probably expected others to continue investing in the public good as in the past, and hence the stronger the record of past contributions of the other players, the higher present-round contributions. The regression output in Table 2 uses only the observations in the panel from the treatment studies, where the tokens circulated. Estimating $\hat{\beta}_4$ through RE using only the control sessions, in a regression where $contPG_{it}^{-i,t-1}$ is the only regressor, yields an estimate of $\hat{\beta}_4$ that is very similar in magnitude to the one in Table 2 ($\hat{\beta}_4 = 0.1060$).

We now estimate the impact of the different tokens and delay on contribution behavior, compared to the control. We regress contributions in round *t* on a dummy for the bracelet study, a dummy for the cardboard study, a dummy for the home object study and a dummy for the delay (equal to one for the control with delay and for all the sessions in which a token was exchanged and equal to 0 only in the control study observations). For this analysis, we use all our participants. The regression model is shown in equation (3). The effect of the dummy variables can only be estimated using the RE model. The regression output is shown in Table 3.

$$contPG_{it} = \alpha_i + \gamma_1 d_i^{bracelet} + \gamma_2 d_i^{cdboard} + \gamma_3 d_i^{homeobj} + \gamma_4 d_i^{delay} + \epsilon_{it} \quad (3)$$

Table 3: the effect of the different tokens and delay on contributions

Coefficient	**RE**
$\hat{\gamma}_1$	1.5813*
$\hat{\gamma}_2$	1.3827*
$\hat{\gamma}_3$	0.3833
$\hat{\gamma}_4$	-0.6250
constant	(omitted)

* p<0.05; ** p<0.01; *** p<0.001.

The model is overall statistically significant. The bracelet and cardboard studies feature significantly higher contributions compared to the control sessions. Contributions are higher in the home object study, but insignificantly so. Delay is associated with lower contributions, but insignificantly so in Table 3. Nonparametric tests (Mann-Whitney and Jonckheere-Terpstra) find, however, significant differences between the sessions in which there is a delay and those that do not feature it ($p<0.01$). Evidence regarding Hypotheses 3 and 4 is, therefore, mixed.

Discussion

Our experimental design captures some of the elements of the Kula, such as the indirect reciprocation of the gift one receives, the public-good nature of the institution of the Kula, and the presence of tokens with no apparent value, but endowed with different degrees of attachment to people. Consistently with previous literature (Duffy & Feltovich, 2002; Palfrey & Rosenthal,

1991), we find a positive association between receiving a signal and contributions to the public good. The finding that the past choices of the other players explain current-period contributions is indicative that past actions were carefully taken into consideration by the players. Duffy & Feltovich (2002) found that in games such as the PGG in which the competition motives prevail over the cooperation aspect, observation of past actions is more effective than cheap talk. Sending the token in our public good game is not a self-committing choice, in the language of Farrell & Rabin's (1996) well-known contribution on cheap talk. Provided that receiving the token is interpreted as an invitation to contribute to the maximum, the sender's best response to the receiver's best response to the message (if trusted upon) is to contribute as little as possible, i.e. free-ride on the other player's contribution (cf. Duffy & Feltovich, 2002). The modest size of the effect of sending and receiving the token on contributions (Table 2) might be an import of the game we chose in our study. Furthermore, receiving the token was a *local* signal, that might have conveyed some information about the strategy of the sender. Still, no token was received from the other 4 groups members, and therefore the only information that was available on their strategies came from the sum of contributions of all the other group members each participant observed in each round's feedback stage.

In our experiment, the players could freely access information on past contributions to the public good, as well as information about the signals. In the Kula no record of past behavior was available, and it is not surprising that the tokens were carefully accounted for and followed in their *keda.* A limitation of our design is that the bracelets and the cardboard pieces featured a high degree of homogeneity, unlike in the Kula district, where the stories that accompanied each object made some tokens much more "informative" and valuable than others. This different degree of desirability of the objects created a complex "strategy space" for the players, in the

sense that choices had to be made not only regarding whether to give but also what one would give and one would solicit from others. This strategic and ceremonial richness of the Kula is lost in our laboratory environment.

While our results show that contributions in the bracelet and the cardboard studies were higher than expected from the control, the results from the home object study are surprising. The concept of "psychological ownership", i.e. the degree to which something feels "mine" (Pierce, Kostova, & Dirks, 2003), might help us interpret this result. It is hard to imagine any psychological ownership for the cardboard pieces and for the bracelets, that looked all very similar. The home object might have induced a higher degree of psychological ownership: renouncing its ownership, which occurred often, might have "excused" the participants from contributing to the PGG. Rather than both being expression of the kindness of the player, sending the home object and contributing to the public good might have been substitutes. Another possible explanation is that the heterogeneity of home objects made the signals difficult to interpret and difficult to associate with intended contribution levels. The cardboard pieces and the bracelets were instead more "standardized" signals.

The size of the effects of the cardboard piece and the bracelet on contributions (Table 3) might seem perhaps low. We know from Table 2 that sending the token is associated with higher contributions. We also know, however, that in most cases the tokens were not sent. One might conjecture that had the tokens circulated more often, the compound effect of the objects circulating in higher numbers might have resulted in even higher contributions in the treatments with a token. One way to test this claim would be to ease the constraint that makes the possibility to send the token contingent on having received one in an earlier round. To this effect, one could increase the number of tokens given to each participant. Future research might find that when

players have several tokens available, many such tokens are sent, and contributions are higher than in our study. On the other side, the greater availability of tokens would decrease the information value of each token, a "hyperinflation" phenomenon. The study of CCB was more accommodating in this regard than ours. Each participant was endowed in fact with *two* tokens in their study. The reason behind the choice of keeping the number of tokens low in CCP's paper is apparent: had each participant been endowed with *many* tokens, it would not have been meaningful to demand a token in exchange for help, and the tokens would have become useless. In our study, even if one had many tokens available, one could still send a token as a signal of the willingness to cooperate, even though the message might be of little information value to the recipient. The absence of tokens for trades can be characterized, according to CCB, as a "liquidity constraint" problem. Liquidity constraints are common in market economies, and were also present, to some extent, in traditional societies. In the circuit of the Kula, objects of the quality solicited by the counterpart might not have been immediately available. In this case, Malinowski (AWP, p. 109) reports that an "intermediary gift" would be given. No such intermediary gifts were available in our experiment. Furthermore, famous objects were obviously in short supply, introducing a dimension of scarcity into an otherwise highly homogenous commodity made of common seashells.

In our experiment, as well as in CCB's, there are two counter-forces at play. On one side the signal should be "valuable," not easily reproduced on the spot (to avoid hyperinflation). On the other, participants should not be overly penalized if they become illiquid. It is an extant challenge to find objects and designs that strike a balance between these two competing dimensions.

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