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THE VALUE OF LIES IN A POWER-TO-TAKE GAME WITH IMPERFECT INFORMATION*

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Abstract

Humans can lie strategically in order to leverage on their negotiation power. For instance, governments can claim that a "scapegoat" third party is responsible for reforms that impose higher costs on citizens, in order to make the pill sweeter. This paper analyzes such communication strategy within a variant of the ultimatum game. The first player gets an endowment, and the second player can impose a tax on it. The former can reject the allocation submitted by the tax-setter. A third party is then allowed to levy its own tax, and its intake is private information to the tax-setter. In a frameless experiment, 65% of the subjects in the tax-setter role overstate the tax levied by the third party in order to manipulate taxpayer's expectations and submit less advantageous offers; on average, for every additional currency unit of lie, measured by the gap between the claimed and the actual tax, they would reduce their offer by 0.43 currency units.

Keywords: Ultimatum game, Taxation, Lies, Deception, Asymmetric information.
JEL Classification: C91; D82; D83.

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1 Introduction

Humans often lie strategically. For instance, governments sometimes need to impose restrictions, new taxes and costly reforms on citizens or groups of citizens. In turn, unpopular reforms can lead to tax evasion, political instability and social unrest, with dramatic consequences for both governments and citizens. In many cases such bitter medicine seems to be better accepted if the government can pretend that a third party shares the responsibility of the restrictions. If we watch back in time only to the period that followed the Asian 1995 crisis, international organizations such as the IMF or the European Union have often been called to play this "scapegoat" role. In some cases, it might pay for the government to set up a third party only to delegate it the right to collect some of the less popular taxes. It might then become interesting for the policymaker to claim that the most difficult reforms or taxes are imposed by the third party, while he is the true initiator. There are many examples in business or private life where strategic communication serves as a tool for leveraging negotiation power.

The ultimatum game (Güth et al. 1982) provides a natural framework for analyzing such interaction. In the standard experimental setup, the two players are referred by the intuitive nicknames *Proposer* and *Responder*. The former is endowed with an amount of money and must make an offer over how to divide this sum between them. The Responder can accept the offer, in which case the allocation is implemented as such, or reject it, in which case both players receive nothing. The subgame perfect Nash equilibrium with pure self-interest predicts that Responders should accept any positive amount. This result has been falsified by an impressive number of tests (Roth, 1995). As documented by Oosterbeek et al. (2004) in a meta-analysis performed on 37 papers, Proposers offer in average no less than 40% of the pie; also, 16% of the offers are rejected.[1] These results have been interpreted as evidence in favor of a fairness concern specific to human beings (Camerer, 2003).

In order to address the tax (costly reform) issue in a straightforward way, we develop a variant of the ultimatum game where the roles of players are inverted, i.e., a power-to-take game, as referred to by Bosman and van Winden (2002). In the baseline scenario, at the outset of the game, the first player – we call him *Receiver* – gets an endowment. Another player, called *Sender*, can tax him a part of this amount. At the end of the game, the first player can either accept this allocation, or reject it thus bringing payoffs of both players down to zero. We then introduce a third agent able to levy his own tax on Receiver, called Computer and played by the computer itself, which can be seen as the "scapegoat" international organization. In our game, there is no scope for cooperation between Computer and Sender.

The two human players – Receiver and Sender – have similar preferences, while Computer is a representation of external random factors beyond the reach of the former ones. Receiver knows the statistical distribution of Computer's moves, but does not know the actual amount taxed. Sender has full information about the move of the machine. He must send a message to Receiver, informing him about this amount, but htis message is unverifiable. At the time when Receiver must decide whether to accept or not the allocation, he will know the amount left in his hands after the successive interventions of the computer and Sender, and has the information sent by Sender about the amount taken by the computer. Sender's strategic advantage over Receiver is twofold: he moves first (after the computer) and has full information about his position in the game. Receiver's negotiation power stems from his ability to turn down the offer submitted by the Sender, at a cost for himself.[2] Like

[1] See Bearden (2001) for an almost exhaustive survey of the litterature on this game.

[2] This is different from the "reverse ultimatum game" by Gneezy et al. (2003) where the Proposer has

in a standard ultimatum game, we expect Receiver to reject "unfair" offers; knowing this, Sender should make offers that Receiver accepts. If we push forward the parallel with policy reforms, a government should be concerned by the political acceptance of any reform; if not, it may find out that people can reject, sometime in the street, any measure perceived as unfair.

The paper contributes to the growing experimental literature on lying and deception initiated by Gneezy (2005). He submits an interesting typology of lies with respect to players' payoffs. If the lie, defined as misrepresentation of reality, brings about an improvement in both players' well-being, we have a "Pareto white lie"; if Sender is worse-off but Receiver is better-off – we have "an altruistic white lie". If Sender is better-off while Receiver is worse-off, this is the typical "selfish lie", which Gneezy (2005) acknowledges to be the most relevant category for many economic events. Taking stock from an Seder-Receiver experiment, he shows that a non negligible number of senders lie to reap some profit, even if this involve a loss for receivers (39% lied if the trade-off is 1$ to 1$: the proportion rises to 52% if the trade-off is 10$ to 10$); subjects' inclination to lie increases if they can get more from the lie, and decreases the more the others lose from it. In his analysis, gains are predetermined, and the individual can choose the "size" of the lie accordingly. Our analysis focuses on the reverse causality: we ask whether people who lie more, do so strategically, in order to increase their gain. Several other recent papers propose a deeper introspection in the aversion to lying or subjective lying costs (e.g., Lundquist, Ellingsen and Johannesson 2009; Erat and Gneezy, 2011; Hurkens and Kartick, 2009; Sánchez-Pagés, 2006; Vanberg, 2008; Charness and Dufwenberg, 2006, 2010; Hao and Houser, 2011).

A first power-to-take game (they call it a demand ultimatum game) with imperfect infor-

a menu of offers, and can submit them until the Responder acccepts one, or can stop the game and set the payoffs to zero.

mation was analyzed by Mitzkewiz and Nagel (1993). An experiment closely related to ours – combining a standard ultimatum game with imperfect information with a message game – was submitted by Croson et al. (2003). In that paper, pairs of subjects play four times an ultimatum game with an outside option for responders if they reject proposers' offer, under various information treatments; more precisely, subjects have known and unknown information about the size of the pie and the outside option. In one unknown treatment, proposers know the size of the pie, actually one of four possible values, while responders know only that it can be anything between two given bounds (10 to 50), without a precise description of the statistical distribution (players are thus submitted to ambiguity). They also allow for players to submit messages between them, and use a dummy variable to record a misleading/true message. At difference with their study, in our experiment players have inverted roles and receivers know the exact statistical distribution of senders' endowment. Proposers' lies are measured by the difference between the claimed and the actual amount, not by a dummy variable.

The main research questions are:

- What are the communication strategies in this special variant of the ultimatum game?
- What is the (subjective) value of a rational lie? More precisely, for 1 euro of difference between the true and the communicated amount (1 euro lie), how much additional money do Senders aim to put in their pockets (in average)?

2 The Experiment

2.1 Design

We run four sessions in the interval from March to May 2011 (see Table 1). All sessions were performed at the Behavioral Research Lab of ESSEC Business School, with a total number of 44 participants. Subjects were recruited from the student population of the school, who answered to a call for paid decision experiments. The experimental design was presented via computer interface and all interactions were computerized. The program was written in z-Tree (Fischbacher, 2007). Each subject was assigned at random with a PC terminal. We make sure that no subject has participated more than once in this experiment. The whole procedure was common knowledge.

Players played the game here below [steps 1 to 6] for six rounds. In order to avoid repetition effects, the pairs of participants were randomly re-matched at each round; the roles (either Sender or Receiver) were also draw at random at the outset of each round.

The main steps are listed below:

Step 1. A the beginning of the party, Receiver (called Player 1) gets 100 experimental currency units (we call them "yens" and inform the students that the actual exchange rate will be 100 yens : 2 euro cash).

The two agents introduced before, Computer (played by the computer itself) and Sender (an anonymous human, called Player 2) will be allowed to withdraw, one after the other, some money from this budget. The Receiver will observe only the funds left at the end of the game.

Step 2. The computer takes a random amount Y ; The draw has a uniform distribution on the support $[0; 50]$.

Step 3. Sender learns Y.

Step 4. He sends a message M to Receiver informing him about the amount Y. If $M = Y$, he tells the truth, if $M \neq Y$, he lies. We will distinguish latter on between a self-interested, rational lie $M > Y$ and an "irrational lie", $M < Y$.

Step 5. He (Sender) then takes for himself an amount Z ($Z \in [0; 100 - Y]$)

Step 6. Receiver gets the message M and observes the amount left in his hands: $R = 100 - (Y + Z)$. He must decide whether to accept or reject the offer of the Sender. If he accepts, the amounts are due; if else, both players get nothing.

Table 1 presents the experience schedule. We run four sessions, two with a warm-up test, two without warming-up. In the warm-up test, the amount Y taken by the computer (at random in the interval $[0, 50]$) is public information. Since Y is known, the sender does not need to issue any message, he just has to decide on his tax Z, given the amount Y. Players play this game for six rounds, before moving to the basic imperfect information set-up (steps 1-6).

"With warming-up" condition		"Without warming-up" condition	
Session 1	Session 3	Session 2	Session 4
N=10 subjects	N=12 subjects	N=10 subjects	N=12 subjects
March 2, 2011	April 29, 2011	April 6, 2011	May 18, 2011

Table 1. Experience schedule

At the end of the experiment, participants received the income of all periods. One virtual currency unit translated into 0.2 euros. In the "with warming-up" condition the experiment took about 60 minutes, and the average income was 14.36€.

2.2 Basic statistics

Table 1 displays the basic average values.

	Overall sample			Accepted offers			Rejected offers		
	Nb	$Z+Y$	$\frac{Z}{(100-Y)}$	Nb	$Z+Y$	$\frac{Z}{(100-Y)}$	Nb	$Z+Y$	$\frac{Z}{(100-Y)}$
With warming-up	66	68.7	0.58	52	66.9	0.56	14	75.2	0.66
Without warming-up	66	62.2	0.50	52	58.5	0.47	14	76.1	0.64

Table 2. Average amount $(Z + Y)$ and ratio $Z/(100 - Y)$

The average amounts $(Z + Y)$, 68.7 and respectively 62.2, are statistically different between the two conditions - with and without warm-up ($t = 2,86, p < 0.05$), while the average Y drew by the computer is almost identical (24.5 vs. 24.1). As expected, whatever the design, accepted offers are in average better than rejected ones.

Figures 1 and 2 present the scatter diagram of Z with respect to Y. In the warming-up condition, the cloud of observations is tight, illustrative of a better understanding of the problem by subjects.

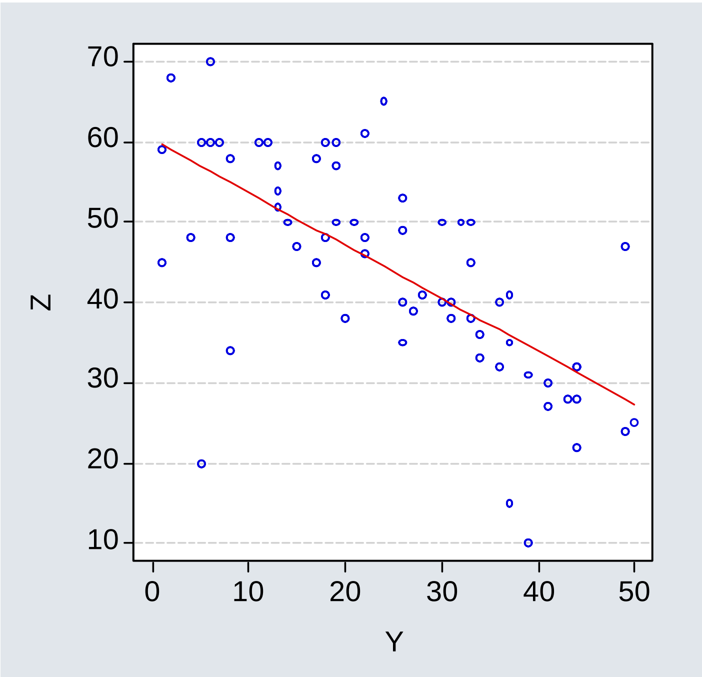

Figure 1: Scatter diagram: Z (amount taken by Sender) on Y (amount taken by Computer) *with* warming-up

Figure 3 and 4 shows the message M (about Y), for given Y, firstly in the no warm-up condition, then in the warm-up condition. In both conditions most observations lie on or above the 45° line, thus indicating the tendency to overestimate the amount taken by the computer.

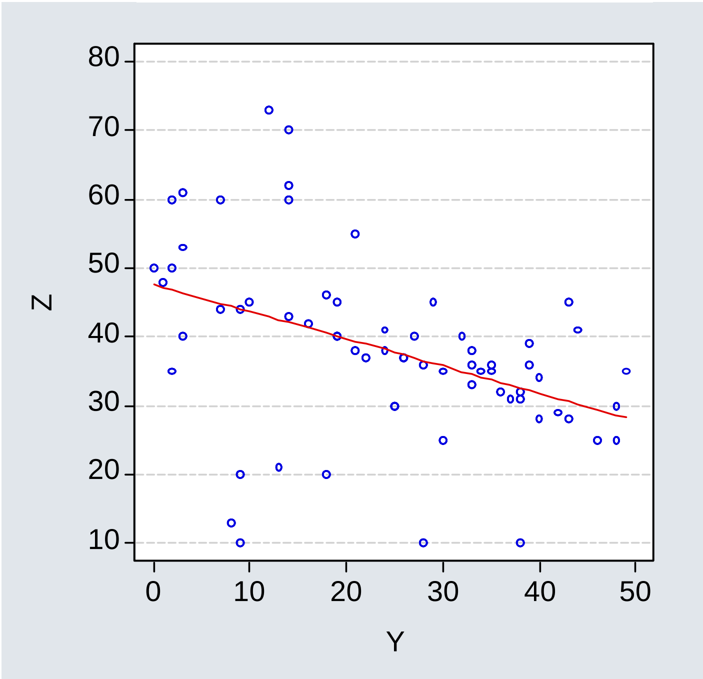

Figure 2: Scatter diagram: Z (amount taken by Sender) on Y (amount taken by Computer) *without* warming-up

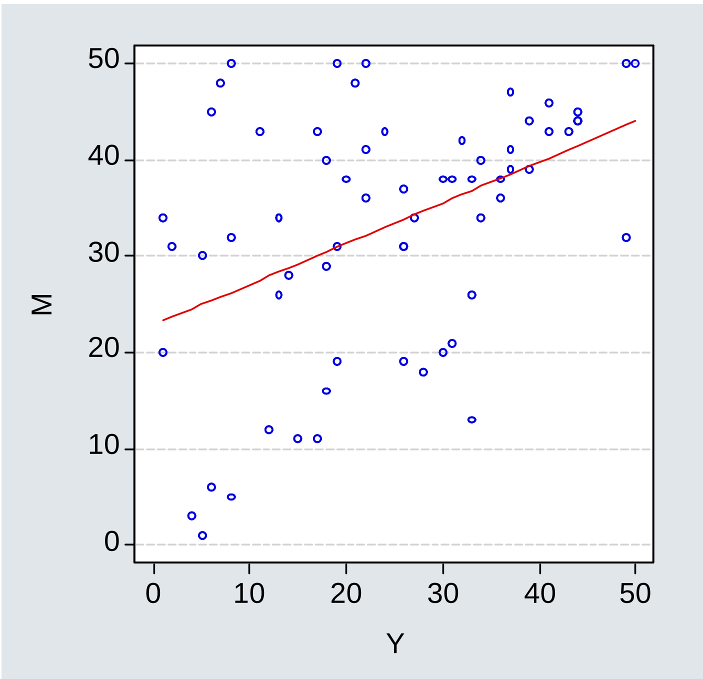

Figure 3: Scatter diagram: M (amount claimed to be taken by Computer) on Y (amount actually taken by Computer) *with* warming-up

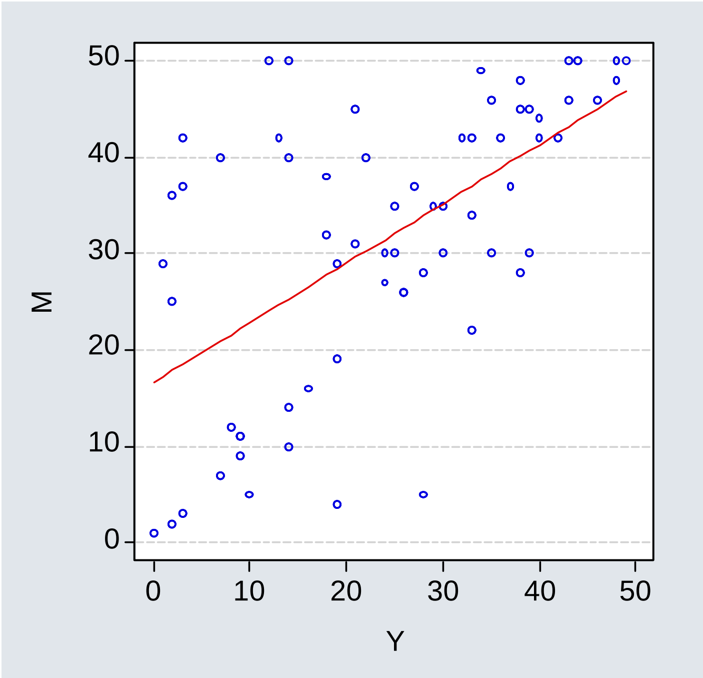

Figure 4: Scatter diagram: M (amount claimed to be taken by Computer) on Y (amount actually taken by Computer) *without* warming-up

2.3 Empirical communication strategies

If there is a cost of lying, some Senders might be tempted to overstate the amount taken by the Computer, in order to manipulate Receiver's expectations, and submit less generous offers. In other words, they would "hide behind the Computer's action" in order to implement a more self-interested action. This outcome can arise only if there are honest Senders, who will tell the truth. The very presence of these honest persons opens the door for others to misbehave (become liars). According to this basic logic, only two categories of persons should exist: honest persons and liars that exaggerate the amount deducted by the computer.

A surprise came with the existence of third category, the "irrational player", who understate the amount taken by the computer. By so doing, they not only bear the cost of lying (we will rule out the possibility of getting some pleasure from telling lies), but also make the Receiver believe that the "remaining pie" is larger than the actual pie; The sender should now tax a lower amount.

For each of the three observed empirical strategies we report in Table 3 the number of times it has occurred (n), the average absolute deviation and the relative deviation. The average absolute deviation is the average difference between the message and the actual amount taken by the computer. The relative deviation is the sum of the differences between the message and the true draw, over the sum of true draws.

		With warming-up			Without warming-up		
TYPE	Strategy	n	Av. abs. dev.	Rel. dev.	n	Av. abs. dev.	Rel. dev.
Liar	$M > Y$	43	13.37	0.59	43	11.35	0.48
Honest	$M = Y$	11	0	0	15	0	0
Irrational	$M < Y$	12	-7.58	-0.25	8	-10.25	-0.28

Table 3: Empirical strategies: Basic statistics

We notice that in both experiments, in 43 over 66 interactions (or 65%) the Sender has decided to overstate the amount taken by the computer. The selfish lie is therefore the preferred strategy.

The Sender told the truth 11 times (15 times) in the "with warming-up" condition (respectively without warming-up).

The 12+8=20 irrational choices were made by only 13 players (who played the role of the Sender three times each). We cannot connect their behavior to the amount taken be the computer. Notice that of the 13 players making an irrational choice, 7 ended up by playing the rational lie or honesty strategy at the last round, and only 6 still played the irrational strategy. Probably these players had some difficulties in understanding the problem.

2.4 The (subjective) value of selfish lies

In order to get an indication of the consequences of lies on the amount taken by the Sender, we can run a regression on Z, the amount taken by Sender, of the amount taken by the computer Y and the difference between the message and the actual amount $(M - Y)$, for each observation k:

$$\text{Model 1:} \quad Z_k = C - aY_k + b(M_k - Y_k) + \epsilon_k \tag{1}$$

Of course, observations collected for one individual over six rounds are not independent (they are independent only within one round), thus such a regression (with pooled data) should be seen only as a rough attempt to extract common coefficients.

The coefficient a indicates the response of the Sender to a one unit increase in the tax taken by the computer, independent of the communication strategy. The coefficient b measures the "pure" lie effect, i.e., what are the consequence on Z of a one unit lie, $M - Y = 1$, when controlling by for the size of the amount taken by the computer.

In order to detect the specific impact of the lies on Z for the two categories of liars (rational and irrational), we also create two dummy variables, DUMLIE that takes value 1 for $M > Y$ and 0 if else, and DUMIR that takes the value of 1 for $M < Y$ and 0 if else. Model 2 allows to identify the specific impact on Z of each type of lie (selfish-rational and accidental-irrational).

$$\text{Model 2:} \quad Z_k = C - aY_k + \rho DUMLIE * (M_k - Y_k) + \gamma DUMIR * (M_k - Y_k) + \epsilon_k \tag{2}$$

Like in model 1, the coefficient a indicates the response of the Sender to a one unit increase in the tax taken by the computer, independent of the communication strategy. The coefficient ρ indicates the pure effect of a selfish lies, and the coefficient γ measures the pure effect of an accidental lie.

	With warming-up		Without warming-up	
	Model 1	Model 2	Model 1	Model 2
C	55.17***	50.06***	41.23***	40.38***
Y	−0.529***	−0.458***	−0.248**	−0.238**
$(M - Y)$	0.223**	–	0.384***	–
$DUMLIE * (M - Y)$	–	0.429***	–	0.426***
$DUMIR * (M - Y)$	–	−0.715**	–	0.189^{ns}
R2	0.49	0.56	0.29	0.30
R2-adjusted	0.47	0.54	0.27	0.26
F-statistic	30.64	27.02	13.27	8.86
Nb. obs	66	66	66	66

Table 4. Estimates of Models 1 and 2 depending on the condition (with / without warm-up game)

(*** statistical significant at 1%, ** statistical significant at 5%; ns - not significant)

A reading of the coefficient a indicates that **for every additional yen taken by the Computer, all other things equal, Sender will reduce his own tax, but by less than one yen (between 0.238 and 0.529, depending on the model).** Hence the total amount available to Receiver declines for every additional euro taken by the computer.

The undifferentiated effect of a lie (coefficient b) is positive in both experiments. When the Sender exaggerates the amount taken by the computer by 1 yen, he does so in order to tax 0.22 (respectively 0.38) more yens.

The effect is stronger in model 2, where we can isolate the impact of selfish lies: the coefficient ρ is large and statistically significant: **for those Senders who choose the**

selfish lie strategy, for every additional currency unit of lie, they tax the Receiver an additional 0.43 units.

3 Conclusion

A government might be limited in his ability to tax or impose costly reforms by a popular rejection of what can be seen as an unfair distribution of wealth. However, citizens might accept higher taxes if some of them are levied by a third party, for instance a supranational organization. If such an external agent exists, a manipulating government might even claim that reforms are actually imposed by this organization while he would be the true initiator.

In order to analyze these complex strategies, this paper develops a power-to-take game (a variant of the ultimatum game): firstly one player receives an endowment, then another player can levy a tax on this amount. We show that, under perfect information, this special game leads to similar pie sharing strategies as the normal ultimatum game: those who submit the offer would keep for them no more than 60% of the pie.

The experiment carried out at the ESSEC Experimental Lab revealed three empirical communication strategies. The most frequent strategy (2/3 of the total interactions) is the selfish lie, where Sender overestimates (by about 50%) the amount taken by the computer.

A simple regression model shows that for every additional currency unit of lie, Sender will raise his intake by 0.43 currency units. Some players will tell the truth, and, some other will underestimate the amount taken by the computer. This latter strategy is hard to understand in this context.

In the framework of the tax tale, if only the tax-setter has complete information about the tax collected by the third party, he can use this information strategically. In particular, Sender (tax-setter) would inflate the actual amount levied by the computer, just in order to push down Receiver's (taxpayer) expectations about the amount left to be shared. This will allow the sender to submit a less advantageous offer for the receiver.

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4 Annex. Basic instructions

Screen 1 : General information

Good Morning,

Thank you for participating to this study.

Please read carefully the following instructions. If you have any question, please call the administrator and ask him the question.

Incentives:

In this experiment, you will be paid according to your performance in the game. Monetary payoffs are denominated in "Laboratory Yen". When calculating your take-home gain, the exchange rate is 50 Yens = 1 euro.

Game description:

You will be submitted to a decision problem, involving a partner chosen at random in the group and involving a random decision taken by the computer.

Individuals in the pair are referred to as Player 1 and Player 2, according to there role in the experiment.

Roles change at each round. At the beginning of each round, your new role will be indicated. Please be to careful to this indication.

Pairs are reset at each round. You will never play twice the same role in a game with the same player.

Screen 2: The basic sequence

Step 0: At the beginning of the game, Player 1 receives a fixed amount of 100 Yens.

Step 1: The computer takes a random amount equal to Y Yens. Y is selected at random among all integers between 0 and 50. Every integer has the same probability (1/50) to be chosen.

Step 2a: The amount Y is communicated to Player 2.

Step 2b: Player 2 can now take an amount equal to Z Yens (an integer between 0 and 100-Y).

At the end of these first steps, endowments are:

- Player 1 : S Yens (with S is the residual amount of the initial endowment after the two withdrawals S=100-Y-Z)
- Computer : Y Yens
- Player 2 : Z Yens

Step 3a: Player 1 knows S (his endowment after the two withdrawals).

Step 3b: Depending on the treatment, an information more or less reliable is provided to Player 1 about the amount Y taken by the computer.

Step 3c: Player 1 must decide if he accepts or not the residual endowment:

- If he accepts it, both players receive the amounts defined above
- If he rejects it, both players receive 0.

Screen 3a: Instructions for Player 1

You are Player 1.

Step 0: At the beginning of the game, you receive a fixed amount of 100 Yens.

Step 1: The computer takes a random amount equals to Y Yens. Y is selected at random among all integers between 0 and 50. Each integer has the same probability (1/50) to be chosen.

Step 2: Player 2 takes an amount on your initial endowment (an integer between 0 and R=100-Y)

At this step, Player 2 knows:

- The amount Y taken by the computer
- The message M that he will provide to you about the value of the amount taken by the computer.

Step 3: You observe:

- The value of S=100-Y-Z
- The signal M provided to you by Player 2 about the amount Y taken by the computer. Player 2 can chose this message strategically.

Step 4: You decide if you accept or not the endowment S.

- If you accept, both players receive the amounts defined above.
- If you reject, both players receive 0.

Screen 3b: Instructions for Player 2

You are Player 2.

Step 0: At the beginning of the game, Player 1 receives a fixed amount of 100 Yens.

Step 1: The computer takes a random amount equal to Y Yens. Y is selected at random among all integers between 0 and 50. Each integer has the same probability (1/50) to be chosen.

Step 2: You receive the following information:

- The amount Y taken by the computer (This amount will not be known by Player 1 when he will make his decision)
- The message M that he will send you about the amount taken by Computer.

You have to:

- Decide about the value M that you are going to communicate to Player 1 about the amount taken by the computer
- Take an amount Z on the endowment of the Player 1 (an integer between 1 and 100-Y)

Step 3: Player 1 receives the following information:

- The value of the amount left S=100-(Y+Z)
- The message M that you provided about the amount Y taken by the computer.

He has to decide if he accepts or not the endowment S

- If he accepts it, you receive the amount Z and he receives the amount S.
- If he rejects it, both players receive 0.

Screen 4: Decision of Player 2

You are Player 2.

Player 1 has received 100 Yens.

Computer has taken an amount equal to Y Yens.

You can now take an amount Z on the residual endowment of Player 1.

You have to choose between all integers between 1 and R=100-Y.

At the end, Player 1 will decide if he accepts or rejects your offer. In this last case, gains of both Players will be zero.

You can now take an amount between 1 and R=(100-Y)= [R] Yens

To decide, you have the following information:

The amount taken by computer is Y=[Y] Yens

To decide, Player 1 will have the following information:

- The residual endowment after the two withdrawals (S=100-Y-Z)

- The amount M that you are going to communicate him about the amount taken by Computer.

Please decide:

a/ Which value of the amount taken by the Computer do you want to communicate to Player 1? M=[M]

b/ Which amount do you want to take? Z=[Z]

Screen 5: Decision of Player 1

You have received a fixed amount of 100 Yens.

The computer has randomly taken an amount and Player 2 did the same.

After these two withdrawals, your residual endowment is: S= [S] Yens.

Player 2 indicates you that the amount taken by the computer was: [M] yens

You have to decide if you accept this offer or not. If you reject it, both you and Player 2 will get nothing..

Please decide:

You accept the offer/ You reject the offer.

Screen 6a: Results Player 1

Results:

Your final endowment was S=[S] yens.

You have accepted/rejected the offer.

Your earning is equal to [S] Yens/0 Yen.

Screen 6b: Results Player 2

Results

You took [Z] yens

Player 1 has accepted./rejected your offer.

Your earning is equal to [Z] yens/0 yen.

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