

# The Endowment Effect and Strategic Behavior in Repeated Procurement Auctions. Implications for Payment for Ecosystem Services Schemes<sup>\*</sup>

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## Abstract

We use an experimental methodology to examine whether bidding behavior in repeated procurement auctions can be explained by a diminishing endowment effect and an increase in strategic behavior over time. Prospect theory tells us that the loss aversion associated with an endowment leads to asymmetries in valuation and exchange behavior. Experience with market mechanisms reduces the endowment effect (List, 2003), while the likelihood of strategic behavior increases with repetition. We hypothesize that by studying the dynamics of these two effects we can determine an optimal number of rounds (*i.e.* at least cost for the auctioneer) in repeated procurement auctions. An application can be found in the procurement of agri-environmental benefits.

**Key words:** Auctions, procurement, endowment effect, learning, strategic behavior.

**JEL codes:** C91, D44, H57, Q57

<sup>\*</sup>We thank participants of the Summer School Experimental Auctions at the University of Bologna, Bertinoro, seminar participants at the 2013 BioEcon Conference, Kings College, Cambridge, and Jason Lusk, Arthur Schram, and Andreas Lange for helpful suggestions and discussion.

## 1. Introduction

Governments and the private sector are increasingly relying on reverse auctions to procure (public) goods and services. As (local) governments continue to focus on core tasks and outsource non-core, yet important functions, they are ever more making use of public tenders and procurement auctions to achieve efficiency (Quinn, 2005, Patel, 2006). Examples are the procurement of contracts for agri-environmental services, such as biodiversity conservation and water management (Latacz-Lohmann and Schilizzi, 2005), electricity generation procurement (Wolfram, 1998, Borenstein *et al.*, 2002), and defense contracting (Dasgupta and Spulber, 1990, Che, 1993). These auctions are usually set up as repeated auctions in the sense that tenders for the same contracts are invited in a sequence of bidding rounds, which allows bidders to learn from the outcomes of previous rounds and use this information to update their bids. An important design challenge here is thus to contain the scope for bidder learning as well as that of collusion (Latacz-Lohmann and Schilizzi, 2005).

While learning over time and collusion may drive asking prices upwards, experience with the auction mechanism could also decrease bids. A possible reason for this is that the required premiums for risk and uncertainty decrease (in the initial rounds of bidding) as bidders acquire a greater understanding on the auction mechanism (*cf.* Rolfe *et al.* 2009). Others claim that such premiums (in the initial rounds of bidding) in fact stem from an endowment effect that causes individuals to value a good or service more once their property right to it has been established (Kahneman *et al.*, 1990). Experience with the auction mechanism reduces this endowment effect and causes bid premiums to decrease over time (Shogren *et al.*, 1994, List, 2003). Evidently, the behavior of experienced traders in for instance electricity markets and defense tenders is not expected to feature an endowment effect. However, it is likely to be a feature of the procurement auctions used in payment for ecosystem services schemes.<sup>1</sup> The reasons being landowners' inexperience with the auction mechanism as new policy gets introduced (Rolfe *et al.*, 2009), and the (sentimental) value that landowners attach to their properties making them value their land more highly than the market (Kahneman *et al.*, 1990).

Conservation auctions are typically discriminatory price auctions with several rounds of bidding (Latacz-Lohmann and Schilizzi, 2005), and although the repeated nature of these auctions gives reasons for concern about strategic behavior, the results from practice show large efficiency gains when comparing them to simple uniform payment schemes. For instance, auctions in the Scottish Challenge Fund Scheme offer a cost reduction of about 35 percent per hectare (CJC

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<sup>1</sup> Sometimes referred to as conservation auctions from now on.

Consultants, 2004), while the (first round of) Australian BushTender auctions would have cost about seven times more when a uniform scheme would have been employed instead (Stoneham *et al.*, 2003). However, Stoneham *et al.* (2003), Hailu and Schilizzi (2004), and Schilizzi and Latacz-Lohmann (2007) show that the discriminatory price auction quickly loses its edge when it is repeated. One of the reasons is that a common-value element may arise making sequential auctions susceptible to strategic behavior. In particular, this is likely to occur in networked industries such as farming, where the highest accepted bid is expected to spread quickly through the farmer community. This combined with the fact that the demand for environmental services is mostly local makes conservation auctions highly susceptible to collusive behavior (Latacz-Lohmann and van der Hamsfoort, 1998, Latacz-Lohmann and Schilizzi, 2005).

This paper examines whether bidder behavior in repeated procurement auctions can be explained by a diminishing endowment effect and an increase in strategic behavior over time. If we find these two effects, we will be able to identify an optimal number of rounds in repeated procurement auctions.<sup>2</sup> Too few rounds of bidding might cause procurement inefficiencies because bidders do not obtain enough market experience and the endowment effect will not disappear completely. However, too many rounds may only drive asking prices upwards since bidders learn to coordinate over time and strategic behavior becomes more likely. Since a multiplicity of possible equilibria in repeated procurement auctions makes an analytical comparison of different auction institutions and of optimal bidding strategies intractable (Schilizzi and Latacz-Lohmann, 2007, Hailu and Thoyer, 2006), there is a strong case for using either agent-based modeling or experimental analysis to further our understanding of behavior in such auctions (Hailu and Schilizzi, 2004). And since we hypothesize that the endowment effect offers one of the explanations for bidder behavior, an experimental analysis is the most suitable approach here.

Our methodology involves a between subject experimental design that embodies three repeated auction treatments. In the discriminatory price sellers (D) treatment, we endow participants with coffee mugs and offer payments equal to bids. The four lowest bidders (out of seven) sell their mug back to the experimenters. We then take the 4<sup>th</sup> lowest price of every round in the D treatment, and use this as an exogenous “predetermined” price in the uniform price choosers (UC) and uniform price sellers (US) treatments. This to ensure that price feedback is

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<sup>2</sup>The optimal number of rounds should be considered here in terms of budgetary cost effectiveness; *i.e.* minimizing the average payment per unit of conservation *over all auction rounds*.

equal across all treatments allowing for the cleanest possible comparison of results. A similar approach can be found in Offerman and Potters (2006).<sup>3</sup>

Bidders in the UC and the US treatments receive a payment equal to the predetermined price if their bids are lower than or equal to this predetermined price. Note that this predetermined price is unknown to the bidders at the moment they submit their bids.<sup>4</sup> Hence, bidders in the UC and US treatment are not able to influence the size of the payments with their bids. In contrast, bidders in the D treatment are not only able to influence their chances of being a seller, but are also able to influence the size of the payments they receive for selling their mug. Hence, while competition (to be one of the sellers) may be a dominant driver of bidder behavior initially, bidders might coordinate on higher bids in later rounds in the D treatment. At the same time, an endowment effect could be present in the first rounds of auctioning, and bidders might lower their endowment premiums as they gain experience with the auction mechanism. The only difference between the UC and the US treatments is that in the US treatment participants are endowed with a mug, while in the UC treatment participants are asked to choose between a payment and a mug. We thus compare the D treatment with the UC treatment to determine whether bidder behavior is influenced by the endowment of the mug, competitive motivations, and strategic behavior. The US treatment is subsequently used to separate the effect of competition and strategic behavior from a possible endowment effect.

To the best of our knowledge, we are the first to investigate both the dynamics of the endowment effect and strategic bidding in procurement auctions at the same time. There are, however, two papers that are closely related to ours. First, Knetsch *et al.* (2001) claim that the value convergence of buyers and sellers over time is an artifact of the second price auction method rather than evidence for a (more general) learning process in *n*th price auctions – they do not find convergence in a ninth price treatment. In other words, buyers and sellers rather seem to respond to possible strategic motivation and the context of the auction institution, than to learn from experience in a market setting and lower their endowment premiums. However, the authors only discuss the endowment effect in relation to bidder learning based on market feedback, and do not go into details on the possibility of bidders behaving strategically over time. Furthermore, like most papers in the willingness to accept-willingness to pay (WTA/WTP) literature (*cf.* Lusk

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<sup>3</sup> In their entry game, the winning entry license bids in a discriminatory price auction treatment are set equal and used as the entry fees randomly assigned to entrants in a fixed entry costs treatment.

<sup>4</sup> Hence, similar to auctions with a (random or unknown) strike price, and aside from a possible endowment effect in the US treatment, it is obvious that a bidder's dominant strategy in the uniform treatments is to bid his/her true opportunity cost (*i.e.* the auctions are incentive compatible) as the bidders are not able to influence prices (Vickrey, 1961).

and Shogren, 2007), the paper is written in the context of designing methods to elicit true valuation. In contrast, our paper is focused on studying the dynamics of bidding behavior in order to obtain an efficient design for procurement auctions, whether bids are equal to true valuation or not.

Second, Rolfe *et al.* (2009) state that when bidders are unfamiliar with services that need to be provided, the opportunity costs involved, and the auction process, multiple bidding rounds are more likely to generate efficient outcomes and are less likely to be characterized by strategic behavior. If, however, the information that is shared between bidding rounds facilitates strategic behavior, multiple bidding rounds may generate inefficient outcomes. The authors analyze a three round procurement auction for biannual conservation contracts in Australia. The bidders were able to update their bids between rounds based on feedback from the previous round and only the bids in the final round were binding. Their results show a huge efficiency increase when comparing successful bids over time: moving from the first to the third round, the government was able to increase the amount of ‘environmental benefit units’ procured with 66% given a fixed budget of AUS \$350,000. With respect to strategic behavior, Rolfe *et al.* argue that the price discovery process, as they call it, rather than strategic behavior drove changes in bid values.

In line with Kahneman *et al.* (1990), we find that the endowment effect has a significant impact on bidding behavior. The average WTA bids for a coffee mug decrease from about €7 to €5 over ten rounds in the US treatment. However, the results from the D treatment do not show signs of bidders coordinating on higher bids in later rounds. Since competitive motivations and the endowment effect seem to drive our results, we do not find evidence for a U-shape in (winning or average) bids over time. In particular, we do not find evidence for an optimal (finite) number of rounds even if we predict bids for an additional ten rounds of auctioning.

The remainder of this paper is organized as follows. In section 2, we present our experimental methodology. Section 3 provides the experimental results. We offer a discussion on our methodology in section 4. Section 5 concludes.

## **2. Experimental design**

We follow Hailu and Schilizzi (2004)’s approach by explaining and quantifying behavioral aspects that commonly constitute bidding in repeated procurement auctions.<sup>5</sup> Recall that we

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<sup>5</sup> For a comprehensive overview of the typical characteristics of conservation auctions see Hailu and Schilizzi (2004), Box 1, p. 150.

hypothesize that bidder behavior can be typified by two effects, namely competitive motivations (including strategic behavior) and the endowment effect.<sup>6</sup>

The *competitive effect* as described by Corrigan *et al.* (2011) asserts that people not only maximize their monetary payoff, but also adjust their bids because they derive utility from winning an auction. In particular, Shogren *et al.* (2000) and Lusk *et al.* (2004) show that bids become more competitive across bidding rounds with the largest changes occurring between rounds one and two. Corrigan *et al.* (2011) argue that if the competitive effect is the only cause of the correlation between bids and auction prices, bids obtained in the first round of bidding will most accurately reflect true preferences. The competitive effect will probably not be one of the main drivers of behavior in procurement auctions in the real world, but is expected to be present and a relatively important driver of behavior in auction experiments given that they feature relatively low monetary payoffs and low value goods (*e.g.* simple coffee mugs or candy bars). In our experiment, we endow students with a “high-end” aluminum coffee mug instead of a simple mug to avoid students bidding low just for the sake of winning the auction.<sup>7</sup>

In auctions that are susceptible to (tacit) *strategic behavior*, the coordination on higher payoffs goes hand in hand with a reduction of the competitive effect. Individuals that take the risk of coordinating on higher bids (expecting to increase their payoffs) reduce their chances of winning, and are therefore by definition less competitive: they put less effort in undercutting each other and trying to be the winner of the auction. Auction theory and empirical studies suggests that bidders will increasingly shade their bids above true valuation in repeated discriminatory price procurement auctions (Riley and Samuelson, 1981, Ashenfelter, 1989, Ashenfelter and Genesove, 1992, McAfee and Vincent, 1993, Bernhardt and Scoones, 1994). These findings imply that over time strategic behavior has the upper hand. As they are two sides of the same coin, we will from now on frequently combine the competitive effect and strategic behavior, and refer to it as a *competitive/strategic effect*.

The *endowment effect* originates from the work of Kahneman and Tversky (1979) and Thaler (1980). Thaler (1980) coined the term endowment effect (closely related to loss aversion) to refer to the finding that randomly assigned owners of an object appear to value the object more than randomly assigned non-owners of the object. Kahneman *et al.* (1990) stress the instantaneous nature of the endowment effect. The authors argue that while previous studies have found the endowment effect for goods that have been a person’s possession for some time

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<sup>6</sup> For a complete account on the behavioral aspects that are expected in auctions in the field and in the lab the reader is advised to consult Corrigan *et al.* (2011).

<sup>7</sup> The mug was not available at the Tilburg University book store when the experiment took place. Comparable mugs are currently available for €12,95.

(sentimental attachment), their study finds that the values that individuals assign to objects such as mugs, chocolate bars, and pens increase substantially as soon as individuals are given the objects.

In the following, we introduce the three between-subject treatments we use to distinguish between the competitive/strategic effect and the endowment effect. All treatments last 10 rounds and end with a value induced token round (see subsection 2.4). The participants are in groups of 7 bidders for ten rounds, but are randomly assigned to groups of 7 again at the beginning of the (11<sup>th</sup>) token round. Experimental instructions including test questions precede the treatments (see Appendix A,B and C). Participants are also given time to ask the experimenter questions. At the end of all treatments, one of the ten rounds is randomly selected to be binding round. The results of the token round and the show-up fee of €5 are added to this randomly selected auction round to determine the final payoffs (also see subsection 2.4).

### *2.1 Discriminatory 4<sup>th</sup> price sellers treatment*

At the beginning of the treatment, before the experimental instructions are read aloud, the participants are given a mug. The mug comes in a box and the participants are asked to open the box and inspect the contents. The participants are then instructed that the item they received is theirs to keep or sell back to the experimenters. In the discriminatory 4<sup>th</sup> price sellers treatment (D), participants are able to influence their chances of being a seller, and are also able to influence their payments: the lowest 4 bidders receive their bid as a payment.<sup>8</sup> Hence, aside from an endowment effect in the initial rounds, we also expect a competitive/strategic effect to be present here. We expect that while a competitive effect may be the dominant driver of bidder behavior at first, and therefore reduce bids in initial rounds, increased strategic behavior will have the upper hand in later rounds as bidders realize that coordinated behavior can positively influence their payoffs. At the beginning of every round, participants determine their bid in the auction by completing the input screen in Figure 1.

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<sup>8</sup> If there are equal bids at the 4<sup>th</sup> price, bidders with equal bids will be selected at random to be sellers (to make a total of 4 sellers).

**Figure 1.** Input screen for every round in the D treatment.

My bid in the auction is € X.x.  
If my bid is among the 4 **lowest** bids  
in my group, I sell my mug for the  
price stated in my bid.  
Otherwise, I keep my mug.

Please choose € X.x :

€  .  0  
(0,1,2,....,15 Euros) (0,10,20,....,90 cents)

Enter a value between € 0.00 and € 15.00  
rounded to tens of euro cents.

At the end of every round, participants are informed about the prevailing 4<sup>th</sup> price in that particular round, and whether they sell their mug and receive a payment *or* keep their mug. After all participants submitted their bids, one of the screens in Figure 2 will be displayed. The participants thus receive the entire bid curve. Also note that the mug is depicted with a red cross through it to emphasize the loss of the mug (in case it is sold in a particular round).

**Figure 2.** Display at the end of every round of the D treatment.

Left: screen that is shown when a bid is not accepted, right: screen that is shown when a bid is accepted.



## 2.2 Uniform price choosers treatment

Participants in the uniform price choosers (UC) treatment are not endowed with a mug, but choose between receiving a mug or a payment. At the beginning of the treatment, before the experimental instructions are read aloud, mugs are handed out by the experimenters and the participants are given some time to inspect it. When the participants are done, the mugs are collected again. In the UC treatment, participants are able to influence their chances of receiving a mug or a payment, but are not able to influence the size of the payment. Participants determine their bid by completing the input screen in Figure 3. After all participants have submitted their bids, the computer will compare the bids of each of the seven participants in their group to a

(group specific) predetermined price. This predetermined price is based on the results of the D treatment. The predetermined price of round 1 in the UC treatment is equal to the prevailing 4<sup>th</sup> price of round 1 in the D treatment, the predetermined price of round 2 in the UC treatment is equal to the 4<sup>th</sup> price of round 2 in the D treatment, and so on. Participants with a bid lower than or equal to the predetermined price receive this predetermined price as their payment. All other participants receive a mug. Note that the predetermined price in a given round is unknown at the moment participants submit their bids.

**Figure 3.** Input screen for every round in the UC treatment.

My bid in the auction is € X.x.  
 If my bid is **lower than or equal to**  
 the predetermined price, I receive  
 this predetermined price.  
 Otherwise, I receive a mug.

Please choose € X.x :

€  .  0  
 (0,1,2,...,15 Euros) (0,10,20,...,90 cents)

Enter a value between € 0.00 and € 15.00  
 rounded to tens of euro cents.

We match the 4<sup>th</sup> prices of the D treatment with the predetermined prices in the UC (and US) treatment to ensure that price feedback will be equal across all treatments. A similar approach can be found in Offerman and Potters (2006). In their entry game, the winning entry license bids in a discriminatory price auction treatment are set equal and used as the entry fees randomly assigned to entrants in a fixed entry costs treatment. This method thus allows for the cleanest possible comparison of results between treatments.

The participants are informed about their results and the choices of others by showing one of the two screens in Figure 4 at the end of every round.<sup>9</sup> Again, the participants receive the

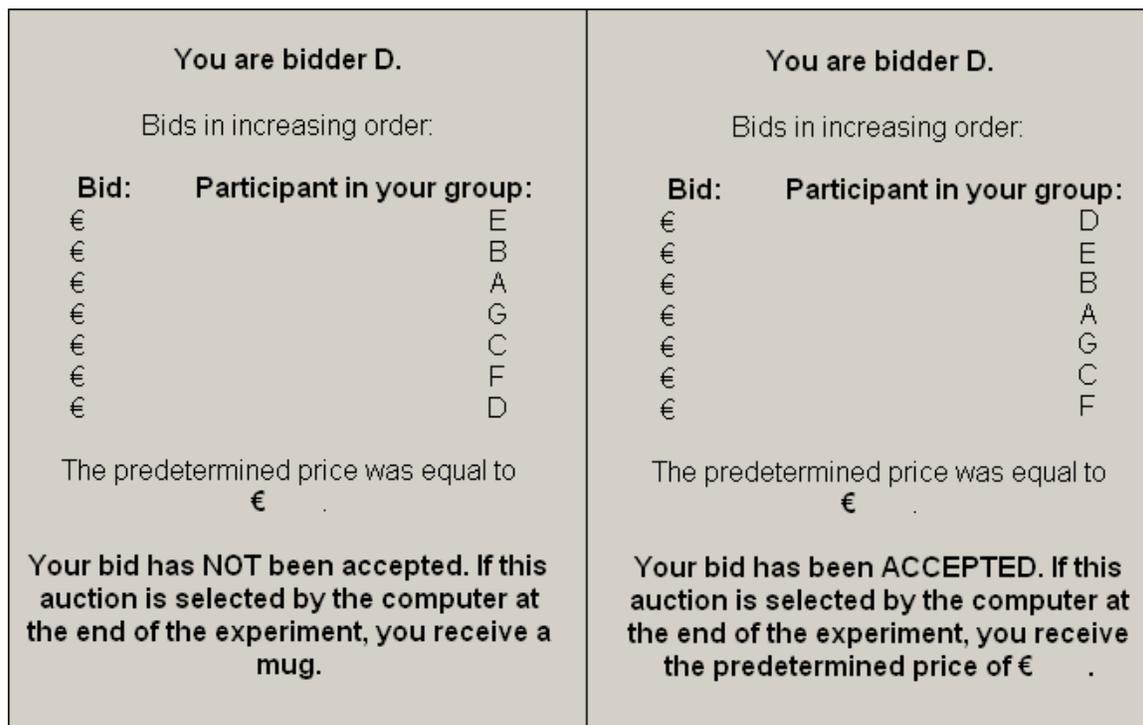
<sup>9</sup> Note here that it is possible that there are no payments. In this case, every participant chooses a payment higher than the predetermined price and everyone receives a mug.

entire bid curve. However, since the participants are not endowed with the mug, there is no emphasize on receiving either a mug or a payment in the form of a picture here.

Since the choice list method (*e.g.* BDM mechanism, see Becker *et al.*, 1964) and the uniform auction method are theoretically equivalent (assuming the latter employs an unknown exogenous price as is the case here), we expect that on average participants bid (close to) their true value in this treatment and do not change their bids over time. We can thus compare the D treatment with the UC treatment to determine whether bidder behavior is influenced by the endowment of the mug, competitive motivations (to win the auction), and strategic behavior; all of which behavioral aspects that are not expected to be present in the UC treatment.

**Figure 4.** Display at the end of every round in the UC treatment.

Left: screen that is shown when a bid is not accepted, right: screen that is shown when a bid is accepted.

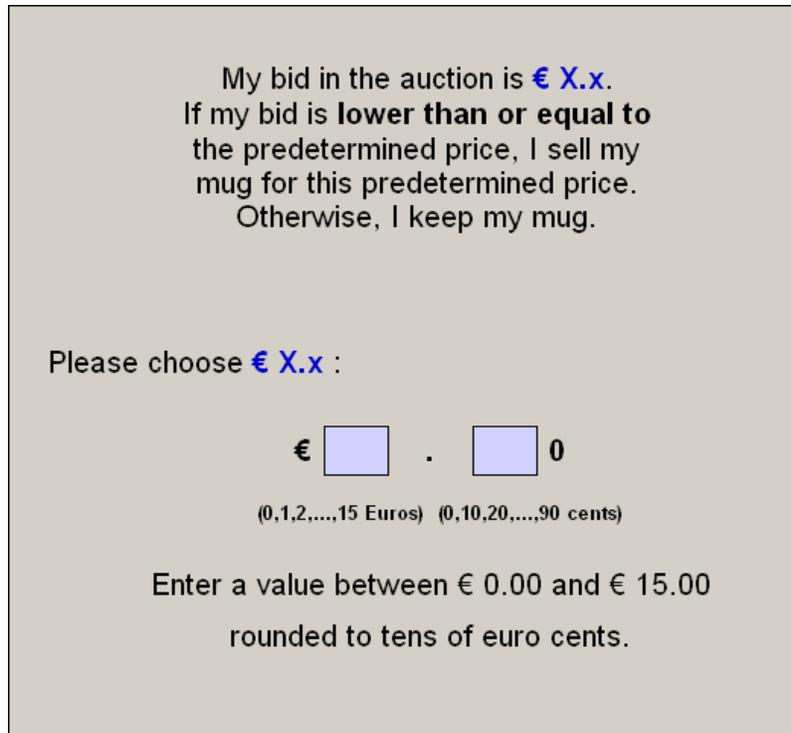


### 2.3 Uniform price sellers treatment

The only thing that changes when moving from the UC treatment to the uniform price sellers treatment (US) is the endowment of the mug (following the same procedure as in the D treatment). Since it is the only difference between these treatment, we can compare the US treatment to the other two treatments to separate the effect of competition and strategic behavior (D vs. US) from the endowment effect (US vs. UC). Again, the prices at which mugs can be sold

in a particular round are given by the predetermined prices obtained from treatment D. Hence, the participants are able to influence their chances of being a seller, but are not able to influence the size of the payments here. Participants are asked to determine their bid in the auction by completing the input screen in Figure 5. Note that the wording is slightly different compared to Figure 3 due to the endowment.

**Figure 5.** Input screen for every round in the US treatment.



My bid in the auction is € X.x.  
If my bid is **lower than or equal to**  
the predetermined price, I sell my  
mug for this predetermined price.  
Otherwise, I keep my mug.

Please choose € X.x :

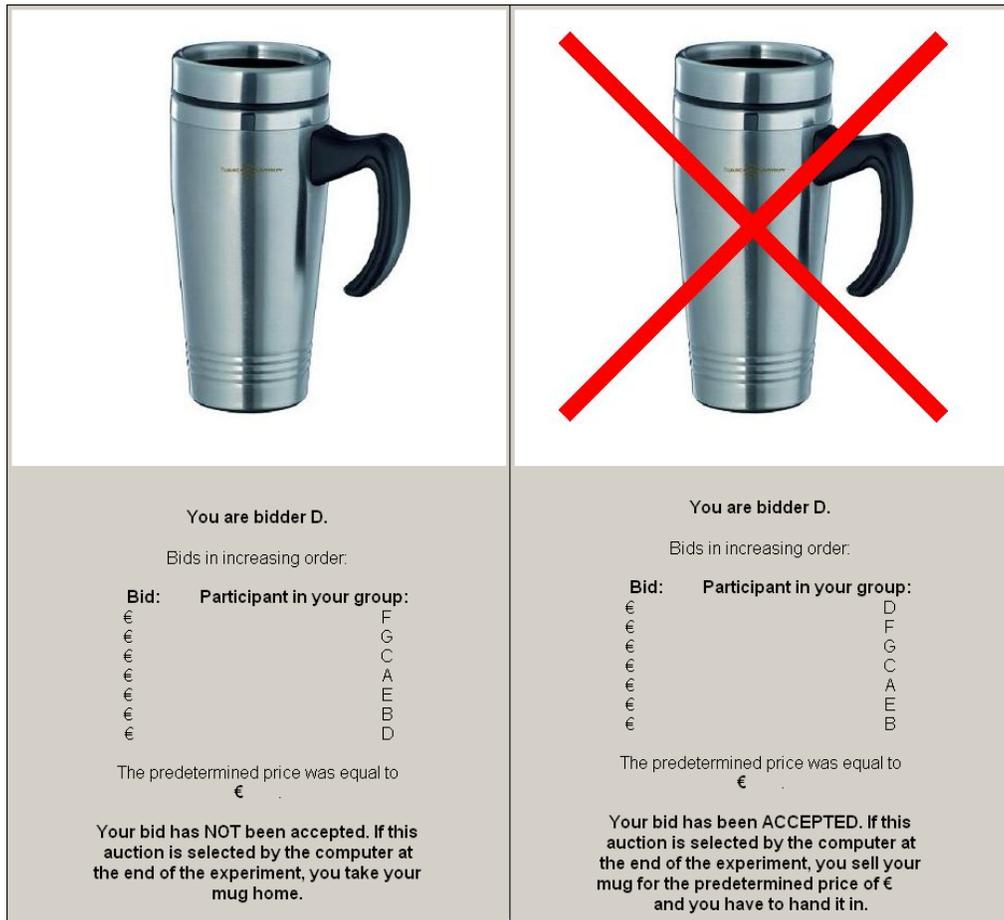
€  .  0  
(0,1,2,....,15 Euros) (0,10,20,....,90 cents)

Enter a value between € 0.00 and € 15.00  
rounded to tens of euro cents.

Again, at the end of every round, participants are informed about the predetermined price for that round and receive information on whether they sold their mug and receive a payment equal to the predetermined price or kept their mug in that round; see Figure 6. To stress the loss of endowment, the mug is again depicted with a red cross through it (in case it is sold in a particular round). Due to the use of a predetermined price in this treatment, the wording is different when compared to the screens shown in the D treatment (see Figure 2), and slightly different from the wording in the UC treatment due to the endowment (see Figure 4).

**Figure 6.** Display at the end of every round in the US treatment.

Left: screen that is shown when a bid is not accepted, right: screen that is shown when a bid is accepted.



#### 2.4 Induced value token round and payoffs

At the end of all treatments, before the round that is selected to determine payoffs is announced, the participants will play a one-shot game with induced value tokens. This additional token round serves as a check to determine whether the participants played as if they understood the auction mechanism (and for treatment D, assumed the other players played as if they understood the auction mechanism as well). The participants are randomly matched to groups again at the beginning of the token round. Participants are informed that they are endowed with a virtual token that has a value between 0 and 150 points, and are told that value of the token is drawn independently for each participant. Furthermore, the participants are informed that they can sell their token by means of the treatment's auction mechanism, and are asked to determine their

selling price for the token.<sup>10</sup> The results of this final round in the UC and US treatments are expected to be equal as there should not exist an endowment effect for a virtual token (and there are no other differences between these treatments). In the D treatment, however, we expect the participants to bid above induced value.

At the end of the token round, one of the ten rounds that is randomly selected to be binding is announced. The participants receive their bids (or the predetermined price) if they sold their mug (received a payment) in this round, and keep (receive) the mug if their bid was unsuccessful in this round. Recall that participants can make bids up to €15.- in the first ten auction rounds. If participants sell their induced value token in the token round, they receive a payment equal to their bid (or the predetermined price) in points times 5 euro cents. If they do not sell their token, they receive the value of their token in points times 5 euro cents. Final payoffs are equal to the show-up of €5, a payment or a mug depending on the outcome of the auction round that is selected to be binding, plus the payoffs from the token round. Since the latter has bids and token values between 0 and 150 points, participants receive payoffs up to €7.50 for their choices in the token round.

### 3. Results

The experiment was performed at Tilburg University and took place during six sessions scheduled over two consecutive days in May 2013. All 126 participants were students at Tilburg University with different nationalities and different academic backgrounds (economics, law, management, social sciences), and were recruited using a mailing list. We were careful to ensure that individuals who participated in one treatment did not participate in another treatment. We ran two sessions of every treatment, resulting in 6 groups of 7 participants bidding in the auctions for every treatment. Each session lasted about two hours. In each session, 21 participants were randomly matched in groups of 7 for the 10 auction rounds, and randomly assigned to groups again at the beginning of the token round. We performed two sessions of the D treatment first to determine the strings of 4<sup>th</sup> prices – for each round and for each group – and used these as the predetermined prices for the groups in the US and UC treatments. The experiment was programmed and conducted with z-Tree software (Fischbacher, 2007).

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<sup>10</sup> Note that in the UC treatment the participants are not sellers. Rather, the participants are told that they can either receive a token that is worth  $x$  points or a payment that is equal to the predetermined price (in points) here. In both the UC and the US treatment, if bids are lower than or equal to the predetermined price, participants receive a payoff equal to this price, otherwise they keep (receive the value of) their token.

The major results of the experiment (Tables 1 and 2, and Figure 7) show large differences in bidding behavior in the three treatments. Table 1 shows that for the average bids over ten rounds ( $n = 6$  groups per treatment) the bids were the highest in the treatments in which the mug was endowed (D and US treatment), and lowest in the UC treatment in which the competitive/strategic effect and the endowment effect are not present. With respect to quantity we find that on average one more mug was sold in the US treatment compared to the (fixed) average of 4 mugs in the D treatment, while on average 6.25 mugs were ‘sold’ when participants could choose to receive a payment or a mug in the UC treatment. The former seems to indicate that, given the same market prices between treatments, on average one participant in the D treatment did not sell his mug while he/she would have preferred to do so. The high average of 6.25 mugs (out of 7) when mugs are not endowed seems to indicate that an endowment effect is present our experiment.<sup>11</sup> Table 2 shows that the average bids in the D treatment were significantly different (5% level) from bids in the UC treatment. Hence, we find evidence for a combined effect of competitive/strategic motivations and the endowment on bidding behavior. In particular, we find that competitive and strategic motivations are significant (10% level) drivers of bidding behavior (D vs. US), and that the endowment effect itself has a significant (10% level) impact on the willingness to accept to part with the mug (US vs. UC).

**Table 1.** Descriptive statistics

| Treatment                              | Average bid    | Average quantity (sold) |
|--|----------------|-------------------------|
| <i>Discr. 4<sup>th</sup> price (D)</i> | 7.22<br>(0.82) | 4<br>(-)                |
| <i>Uniform price sellers (US)</i>      | 5.81<br>(0.54) | 4.97<br>(1.34)          |
| <i>Uniform price choosers (UC)</i>     | 3.25<br>(0.33) | 6.25<br>(0.98)          |

Standard errors are in parentheses.

**Table 2.** Competitive/strategic and endowment effect testing

| Treatment comparison       | Diff. in average bid | Wilcoxon matched pairs |
|----------------------------|----------------------|------------------------|
| <i>D vs. UC treatment</i>  | 3.97                 | $p = 0.028$            |
| <i>D vs. US treatment</i>  | 1.41                 | $p = 0.075$            |
| <i>US vs. UC treatment</i> | 2.56                 | $p = 0.075$            |

The Wilcoxon matched pairs test is based on the null hypothesis that the distributions of bids are the same for all matched groups (with the same price paths).

<sup>11</sup> A Wilcoxon matched pairs test shows that the average quantity ‘sold’ in the UC treatment is significantly different from the average quantity sold in the US treatment (5% level).

Figure 7. Average bids per treatment over time

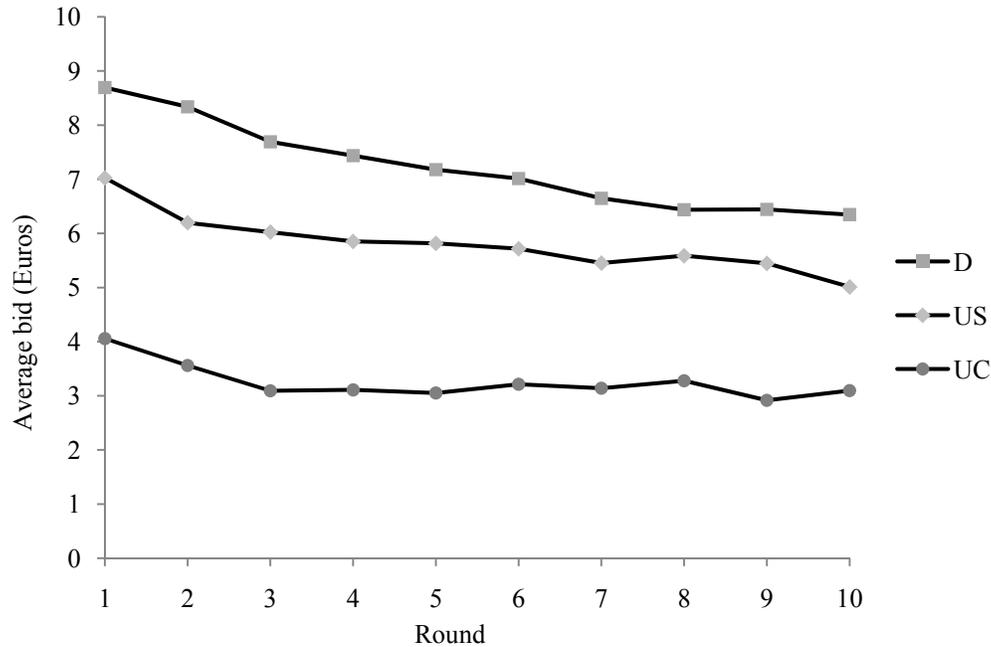


Figure 7 shows the average bids per treatment over time. Visual inspection of the bids in the D treatment shows no sign of bidders coordinating on higher bids in later rounds.<sup>12</sup> Table 3 offers the average bids at the beginning (Rounds 1 & 2) and the end (Round 9 & 10) of the auction treatments. It shows that the endowment effect seems to drive results: the average bid is significantly decreasing (5% level) over time in the US treatment. The presence of competitive motivations and the lack of strategic behavior in the D treatment only strengthens this decrease in bids. As was expected, the high  $p$ -value for the UC treatment indicates that there is little evidence for bids decreasing over time when an incentive compatible mechanism is used to elicit the willingness to receive either a mug or a payment. The results of the induced value token round confirm that participants played as if they understood the auction mechanism in all treatments.<sup>13</sup>

<sup>12</sup> Observations at the group level also do not show bidders coordinating on higher bids in later round in the D treatment. Bids tend to decrease (and converge) over time. There are two exceptions: in one group the average bid increases slightly in the first two rounds only to decrease again in later rounds, while in another group the average bid decreases but is increasing in the last two rounds. In the latter case, this is mainly due to one individual suddenly bidding 15 Euros in the last two rounds while bidding around 5 Euros in previous rounds.

<sup>13</sup> Only in the token round of the UC treatment did a substantial group participants make suboptimal decisions. However, the bidders that made suboptimal decisions in this token round did not bid significantly different in the ten rounds of the auction treatment compared to participants that did bid optimally in the token round. Hence, the observation that these participants made suboptimal decisions in the token round should not be a reason for concern.

**Table 3.** Average bids of first two vs. last two rounds

| Treatment                                  | Round 1 & 2    | Round 9 & 10   | Wilcoxon matched pairs |
|--|----------------|----------------|------------------------|
| <i>Discr. 4<sup>th</sup> price auction</i> | 8.52<br>(1.46) | 6.40<br>(1.37) | $p = 0.028$            |
| <i>Uniform price auction (sellers)</i>     | 6.61<br>(2.03) | 5.23<br>(2.61) | $p = 0.035$            |
| <i>Uniform price auction (choosers)</i>    | 3.81<br>(1.77) | 3.01<br>(0.83) | $p = 0.116$            |

Note: standard errors are in parentheses. The Wilcoxon matched pairs test is based on the null hypothesis that the distributions of bids for Round 1 & 2 and 9 & 10 are the same for all matched groups (with the same price paths).

As is apparent from the extent literature, the convergence process of bid behavior in procurement auctions is not understood theoretically. From a practical point of view, we can thus assume that serial correlation and heteroskedasticity are present in our data. In absence of a well-developed theory of how bids behave over time, we can then apply the model used in Noussair *et al.* (1995) – a model that is frequently used to analyze the effect of time on the outcome variables in experiments. In other words, we can model the expected convergence process and use it to predict bids as if we let the participants continue auctioning after round 10. The following specification of bid values over time is based on one of the models used in Noussair *et al.* (1995).<sup>14</sup>

$$Bid_{it} = \beta_1 UC \frac{1}{t} + \beta_2 UC \left(\frac{1}{t}\right)^2 + \beta_3 UC \frac{t-1}{t} + \beta_4 US \frac{1}{t} + \beta_5 US \left(\frac{1}{t}\right)^2 + \beta_6 US \frac{t-1}{t} + \beta_7 D \frac{1}{t} + \beta_8 D \left(\frac{1}{t}\right)^2 + \beta_9 D \frac{t-1}{t} + u \quad (1)$$

Here,  $UC$ ,  $US$ , and  $D$  are treatment dummies,  $t$  is the auction round, and  $u$  is the random error term distributed normally with mean zero. Table 4 shows the estimation results of the model expressed in (1).

<sup>14</sup> Specifically, we added the three  $\beta_x DUMMY/t^2$  terms to Specification 1 in Footnote 5 of Noussair *et al.* (1995) to allow for more freedom in the shape of the convergence process.

**Table 4.** Noussair *et al.* (1995) model GLS estimation results

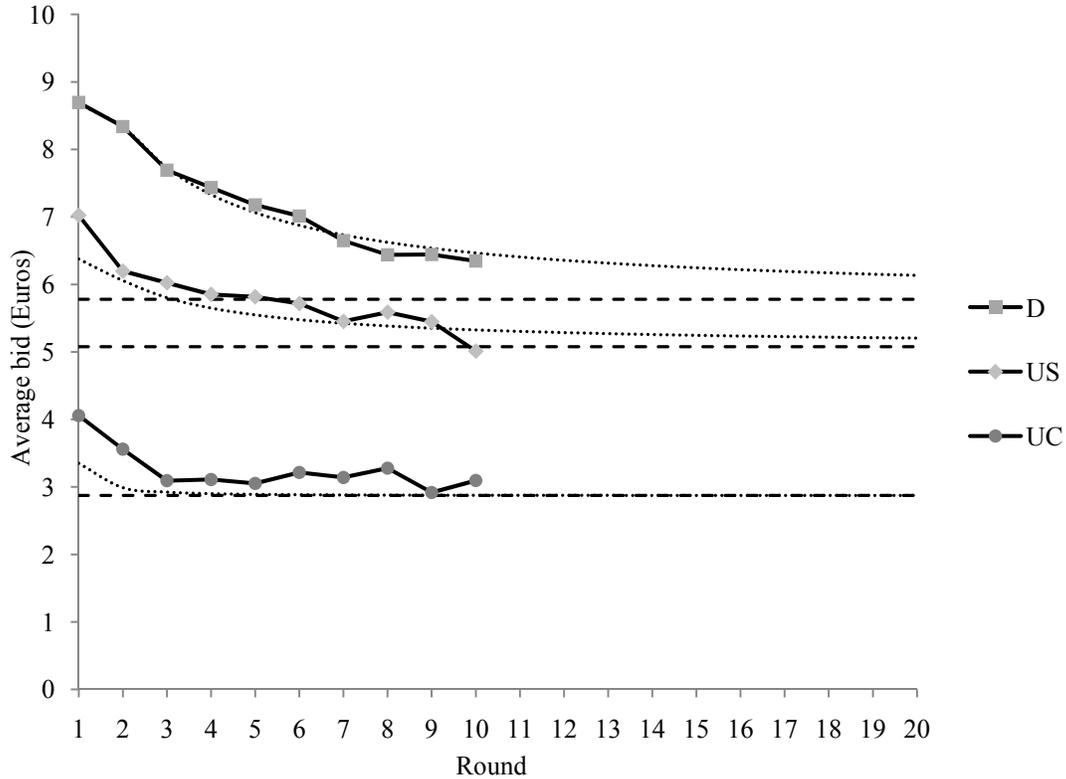
| Dependent variable: Bid      | I                     | II                     |
|------------------------------|-----------------------|------------------------|
| <i>UC/Round</i>              | 3.572 ***<br>(0.1256) | 2.858 ***<br>(0.4942)  |
| <i>UC/Round</i> <sup>2</sup> | -                     | 0.4927<br>(0.4298)     |
| <i>Asymp_UC</i>              | 2.797 ***<br>(0.1145) | 2.874 ***<br>(0.1605)  |
| <i>US/Round</i>              | 6.2 ***<br>(0.1524)   | 7.695 ***<br>(0.6476)  |
| <i>US/Round</i> <sup>2</sup> | -                     | -1.319 **<br>(0.569)   |
| <i>Asymp_US</i>              | 5.313 ***<br>(0.1251) | 5.078 ***<br>(0.1939)  |
| <i>D/Round</i>               | 8.442 ***<br>(0.1254) | 13.09 ***<br>(0.5758)  |
| <i>D/Round</i> <sup>2</sup>  | -                     | -4.417 ***<br>(0.5215) |
| <i>Asymp_D</i>               | 6.59 ***<br>(0.0927)  | 5.78 ***<br>(0.1511)   |
| <i>n</i>                     | 1260                  | 1260                   |
| $\chi^2$                     | 11,656                | 11,117                 |

Note: \*, \*\*, and \*\*\* indicate significance at the 10%, 5%, and 1% level, respectively. Standard errors are in parentheses.

The Noussair *et al.* (1995) model is estimated using generalized least squares allowing for subject specific AR(1) processes and heteroskedasticity. Except for the coefficient on  $UC/t^2$  ( $p$ -value = 0.252) in specification II, all terms are significant in specifications I and II. Although the Wald Chi-squared is not significantly larger for specification II (it is in fact smaller), the  $US/t^2$  and  $D/t^2$  terms are significant at the 1% level. We will thus use specification II for our predictions.<sup>15</sup> Note that a Wooldridge test for autocorrelation in panel data rejects the null of no first-order autocorrelation. The likelihood ratio test for nested models rejects the null of no heteroskedasticity. Using the fitted values of the asymptote model estimated in specification II, and assuming this model correctly estimates bidding behavior, we can predict the average bids as if participants continued playing an additional ten rounds; see Figure 8.

**Figure 8.** Predicted and observed bids per treatment based on the Noussair et al. (1995) model

<sup>15</sup> Since the asymptotes do not differ that much between specifications, using the fitted values in specification I to predict bids yields similar results as in Figure 8.



The dotted lines represent the fitted values of specification II. The asymptotes are given by the dashed lines. The average bids per treatment are copied from Figure 7. Visual inspection of the figure shows almost instant converge to an average bid of €2.90 in the UC treatment. Convergence of average bids in both the US and D treatment is much slower and yields predictions of bid converge to €5.10 and €5.80, respectively. Note that the Noussair *et al.* (1995) model leads to convergence by construct and thus limits our possibilities of predicting a U-shaped average bid curve over time for the D treatment – *i.e.* there is a low chance of predicting that bidders coordinate on higher bids in later rounds. However, a simple quadratic specification yields similar results as in Figure 8.<sup>16</sup> Hence, also when we predict bidding behavioral for an additional ten rounds, we do not find evidence for coordination on higher prices in later rounds. The earlier observation that on average one participant in the D treatment did not sell his mug while he/she was one of the five bidders in the market to win the auction thus seems to have frustrated attempt to coordinate bids. Competition among bidders together with a diminishing endowment effect seem to have the upper hand in reducing prices over time in our experiment.

#### 4. Discussion

<sup>16</sup> GLS estimation of  $Bid_{it} = \beta_1 UCt + \beta_2 UCt^2 + \beta_3 UC + \beta_4 USt + \beta_5 USt^2 + \beta_6 US + \beta_7 Dt + \beta_8 Dt^2 + \beta_9 D + u$  in fact yields insignificant coefficients on the quadratic terms for the D (and the US) treatment.

Given the controversy on the existence of an endowment effect, we are obliged to give a short summary on the ongoing debate in the literature. Plott and Zeiler (2005) argue that while experimenters are careful to control for misconceptions, there is no consensus about the fundamental properties of misconceptions and how to prevent them. In their paper, they try to find whether the endowment effect can be related to the nature of preferences or is simply a measurement error due to the lack of proper controls for misconceptions. The authors find that when using an incentive compatible mechanism to elicit valuations, and subjects are provided with (1) a detailed explanation of the mechanism and how to arrive at valuations, (2) paid practice rounds using the mechanism, and (3) anonymity, there is no significant WTA/WTP gap. This suggests that also in repeated auctions the endowment effect will completely disappear if sufficient learning has taken place over time.

Isoni *et al.* (2011) replicate Plott and Zeiler's results of WTA/WTP disparity for (monetary) lotteries (*i.e.* the practice tasks in their paper), and also find that the gap does not exist for mugs. While Plott and Zeiler argue that the WTA/WTP gap disappears with (paid) practice, Isoni *et al.* argue that if the variation in WTA/WTP disparities is attributable to differences in controls for misconceptions, the elimination of disparities in valuations of one good should be associated with the elimination of disparities in valuations of others. Hence, the authors argue that, it is not credible that misconceptions about a common set of elicitation procedures persist, without any obvious tendency for decay, over a series of paid lottery tasks and then suddenly disappear when subjects are faced with the mug task (as is found in Plott and Zeiler and the replication of their experiment). Furthermore, they argue that Plott and Zeiler go to great lengths to reduce the distinction between buying and selling tasks. For example, both buyers and sellers have a mug in front of them when faced with the task of making a WTA/WTP offer. Isoni *et al.* state that such cues and reference points (*e.g.* the physical possession of the object) have an effect on the WTA/WTP disparity, but there is no reason to assume that controlling for them or 'turning them off' is the default state in transactions outside the laboratory.

We believe that, aside from using pre-auction test questions, our experiment is most realistic when it is not preceded by (paid) practice rounds. In essence, this does not differ from introducing new policy (*e.g.* a conservation auction) to agents in an industry that have no experience with it. Our claim is supported by Rolfe *et al.* (2009)'s observation that conservation tenders are rare, specialized, and often feature landowners that are being asked for the first time to specify the environmental services to be provided and to identify the costs for the provision of such services. However, our argument mainly ties in with the statement made by Isoni *et al.* on

cues and reference points. In other words, why should we train our subjects before running our experiment if in most newly introduced procurement tenders the bids in the initial rounds are also expected to be based on different individual cues and reference points (*e.g.* some farmers own family farms while other bidders having no sentimental value towards property whatsoever).

Now we are left with the most obvious remark one could make: mugs are not land. While this might be true, we believe that our results have implications beyond the lab. Kahneman *et al.* (1990) stress the instantaneous nature of the endowment effect as their most important result and our results are no different from the ones reported in their paper. Even though students are given the mug just moments before they start bidding in the auction, we find significant differences in bids (and quantities) between the treatments in which the mug is endowed and the treatment in which it is not. Furthermore, while the endowment effect is even found for candy bars and pens, we insisted on auctioning a “high-end” mug as to increase the chances that the endowment effect expected for it is more comparable to an endowment effect expected for goods with sentimental value (such as the ownership of land that belongs to a family farm). However, our approach still differs from the typical characteristics of conservation auctions in several ways: (1) While we use a fixed target of 4 units in every round of the D treatment these auctions are typically characterized by a fixed budget, (2) bidders have to bid in every round instead of having the choice to participate, and (3) bidders in the experiment sell a single homogeneous unit compared to farmers supplying a multitude of heterogeneous ecosystem services in practice.

With respect to (1), when a fixed target is employed, the total amount of land that is procured or put under contract is decided upon and known. Hence, here the risk is that an auction might end up costing much more than expected. In general, target-constrained auctions are used where government cannot fall short of its objectives, as is for instance the case with military spending. Frequent use of budget-constrained auctions probably reflects the general political priorities of governments in the field of environmental policy. Latacz-Lohmann and Schilizzi (2005) find that there is no reason to suggest that one format performs better than the other: both formats perform equally well, be it for repeated or one-shot auctions. With respect to specific auction characteristics however, Knetsch *et al.* (2001) show that the fixed target chosen (*i.e.*  $n^{\text{th}}$  price employed) has an impact on bidder behavior. In a (uniform)  $2^{\text{nd}}$  price treatment, the authors find that since only one mug will be sold back to the experimenter every auction round, the (ten) bidders expect a relatively low offer to set the price and make offers accordingly. Here, the authors find a drift down in asking prices over the repeated trials. However, in the (uniform)  $9^{\text{th}}$  price treatment, a large WTA/WTP gap is found that in fact increases over subsequent trials. Hence, here the bidders likely assumed that with eight mugs to be sold at the next to highest offer

(the ninth lowest bid), the price would be relatively high and therefore submitted offers with this in mind. Competition has the upper hand in our results and we do not find evidence for strategic behavior. However, in light of these result, it is expected that when five or more bidders could win the auction, this would most likely lead to more strategic behavior.

With respect to (2), although we did not give the participants in our experiment a choice to participate, bidders were able to keep their endowment in the experiment by bidding well above the expected prevailing auction price.<sup>17</sup> However, farmers that do not participate at first can be informed by farmers that did participate and can choose to join in later rounds. A treatment with voluntary participation is left for future research (*cf.* Menezes and Monteirrom, 2000). Finally, with respect to (3), in practice, a metric is usually employed to calculate an environmental benefits index in order to rank bids of farmers that offer multiple (heterogeneous) services. Using such a metric, Rolfe *et al.* (2009) show a huge efficiency increase when comparing successful bids over time: moving from the first to the third round, the government was able to increase the amount of ‘environmental benefit units’ procured with 66%. In other words, competitive behavior for multiple (heterogeneous) units is clearly present when such a metric is employed. Furthermore, the authors state that when bidders are unfamiliar with the auction process, which seems likely if such a metric is introduced, this decreases the likelihood of strategic behavior.

## 5. Conclusion

This paper examines whether bidder behavior in repeated procurement auctions can be explained by a diminishing endowment effect and an increase in strategic behavior over time. We find that the endowment effect has a significant impact on bidding behavior – average WTA bids decrease from about €7 to €5 over ten rounds in a uniform price auction treatment. However, the results from a discriminatory 4<sup>th</sup> price auction do not show signs of bidders coordinating on higher bids in later rounds. Since competitive motivations and the endowment effect seem to drive our results, we do not find evidence for a U-shape in (winning or average) bids over time. In particular, we do not find evidence for an optimal (finite) number of rounds even if we predict bids for an additional ten rounds of auctioning.

Our results are thus in line with those of Rolfe *et al.* (2009) in suggesting that procurement auctions for environmental benefits become more efficient with repetition. However,

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<sup>17</sup> Only in the UC and US treatments did a few participants bid close (or equal) to €15 for the duration of the auction treatments – they thus received a mug / kept their mug in all auction rounds. Note however that as compared to the D treatment, this could also indicate that participants were indifferent between taking a mug home or gambling on possibility of the predetermined price being very high in one of the auction rounds.

the results of Knetsch *et al.* (2001) suggest that this claim depends on the details of the auction institution. In particular, when we increase the amount of bidders that could potentially win the discriminatory price auction (*i.e.* increase the  $n^{\text{th}}$  price), strategic behavior is more likely to affect the auction's competitive edge over time (*cf.* Stoneham *et al.*, 2003, Hailu and Schilizzi, 2004, and Schilizzi and Latacz-Lohmann, 2007).

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## **Appendix**

### ***A: Experimental instructions Discriminatory 4<sup>th</sup> price treatment***

#### **INSTRUCTIONS**

You are about to participate in an experiment on individual decision making. Before we start, we would like to ask that you do not communicate with other people during this session. Please also turn off your mobile phone.

The experiment consists of two parts. The instructions for the first part, Part I, will be read out aloud now, and you are invited to read along. After completion of Part I of the experiment, you will receive the instructions for Part II, and then Part II will take place.

#### **INSTRUCTIONS FOR PART I**

You receive a show-up fee of €5 for being here today. The mug that you just received, is yours.

Depending on your decisions in Part I, you can take your mug home, but you may also decide to sell it back to the experimenters for a monetary payment.

Whether you take your mug home or sell it back for a payment in Part I is determined in a special kind of auction. In the auction format used in this session, the auction participants are not bidding to BUY an item, but to SELL an item. In this auction, you decide what price you are willing to sell your mug for. The price that you submit, is called your bid.

There are 7 participants in your group, you and 6 other individuals in this room. All participants submit their bids simultaneously. That means that at the moment that you submit your bid, you do not know what bid any other participant submits.

After all participants have submitted their bids, the computer will rank all bids of the seven participants in your group from the lowest bid to the highest bid. We buy back the mugs from the participants who ask the lowest price in their bid.

If your bid is among the LOWEST four bids in your group, your bid is ACCEPTED in this auction.

If your bid is NOT among the lowest four bids in your group (but among the highest three), your bid is NOT accepted in this auction.

The auction will not just take place once; it will be repeated ten times. However, you only have one mug that you can keep, or sell. We implement this as follows. After both Part I and Part II have been completed, the computer randomly selects which of the ten auctions you participated in in Part I, will be implemented.

If, in that randomly selected auction, your bid was NOT accepted (that is, if it was NOT among the LOWEST four bids in your group), you take your mug home, as well as the €5 show-up fee plus any earnings you receive in Part II.

If, in that randomly selected auction, your bid was ACCEPTED (that is, if it WAS among the LOWEST four bids in your group), you have to hand in your mug, but you receive the price that you stated in your bid, as well as the €5 show-up fee plus any earnings you receive in Part II.

All earnings will be paid to you via bank transfer within 48 hours.

Each of the ten auctions is independent, because the outcome of only one will be implemented.

We will now explain the auction rules that apply in each of the ten auctions you will participate in in more detail.

### **THE PROCEDURES**

Auctions take place with 7 participants in a group – you, and six other individuals in this room. You are matched with the SAME six participants in each of the ten auctions in Part I.

In each auction, you can bid any amount between 0.00 and 15.00 Euros. Bids can be in full Euros, but also in tens of euro cents. For example, you can bid Z Euros and 10 cents, Z Euros and 20 cents, etc., but not Z Euros and 15 cents, or Z Euros and 16 cents.

All participants submit their bids simultaneously. At the moment that you submit your bid, you thus do not know what bid is submitted by any other participant.

After all participants have submitted their bids, the computer will rank the bids of the seven participants in every group from the lowest bid to the highest bid.

After the computer has ranked all bids of your group, you will be informed of the bids of the six other participants in your group. You will then also be informed whether your bid was ACCEPTED, or NOT.

If your bid is ACCEPTED in this auction (that is, if it is among the LOWEST four bids in your group in this auction) and if, at the end of the session (after both Part I and Part II have been completed), this auction is randomly selected by the computer, you receive the price that you asked for in your bid, and you have to HAND IN your mug.

If your bid is NOT accepted in this auction (that is, if your bid is among the highest three bids in your group in this auction) and if, at the end of the session (after both Part I and Part II have been completed), this auction is randomly selected by the computer, you KEEP your mug, and you do not receive the price that you asked for in your bid.

In case of “ties”, the computer will randomly determine which bids are accepted. If, for example, the 4<sup>th</sup> and 5<sup>th</sup> lowest bids are the same, the computer will randomly determine which of the two will be

accepted. If the 3<sup>rd</sup>, 4<sup>th</sup> and 5<sup>th</sup> lowest bids are the same, the computer will randomly determine which two of the three bids will be accepted, etc.

This completes the description of the auction. The procedure is repeated ten times. The outcome of each of the ten auctions is thus whether your bid was ACCEPTED, or NOT, and one of these ten outcomes will be implemented at the end of the session. As stated before, the other bidders in all the auctions you participate in, are always the same six individuals.

Let us now have a look at the screens.

## SCREENS

The first screen is the following.

*SCREEN 1:*



Auction of 10

My bid in the auction is € X.x.  
If my bid is among the 4 lowest bids  
in my group, I sell my mug for the  
price stated in my bid.  
Otherwise, I keep my mug.

Please choose € X.x :

€  .  0  
0,1,2,...,15 Euros| 0,10,20,...,90 cents

Enter a value between € 0.00 and € 15.00  
rounded to tens of euro cents.

Help  
Please select a value for your bid. Enter a value for euros in the left field and a value for tens of euro cents in the right field. Click on the 'Update value' button to display your selected value for € X.x (this is not your final decision).  
If you are absolutely sure that this should be your bid in this auction, then click on the 'Submit bid' button.  
You can update your bid as many times as you want. Clicking the 'Submit bid' button makes the chosen value your final bid for this auction.  
The current auction is displayed in the top left corner.

On the top-left part of this screen, you are informed about which of the ten auctions you now participate in. On this screen you are requested to submit a bid. You can enter a value for Euros (in round numbers, 0,1,2,...,15) in the left field and a value for euro cents (in multiples of ten cents, 0, 10, 20, ...90 cents) in the right field – note that the 0 is preprinted, so enter “1” if you want to enter “10 cents”.

Suppose you entered a bid of X.x0 Euros. After clicking on the “Update value” button, the next screen will appear.

SCREEN 2:

Auction of 10

My bid in the auction is € .  
If my bid is among the 4 lowest bids  
in my group, I sell my mug for the  
price stated in my bid.  
Otherwise, I keep my mug.

Submit bid

I want to revise my bid :

€ . 0  
0,1,2,...,15 Euros 0,10,20,...,90 cents

Enter a value between € 0.00 and € 15.00  
rounded to tens of euro cents.

Update value

Help  
Please select a value for your bid. Enter a value for euros in the left field and a value for tens of euro cents in the right field. Click on the 'Update value' button to display your selected value for € X.x (this is not your final decision).  
If you are absolutely sure that this should be your bid in this auction, then click on the 'Submit bid' button.  
You can update your bid as many times as you want. Clicking the 'Submit bid' button makes the chosen value your final bid for this auction.  
The current auction is displayed in the top left corner.

The bid that you entered, will appear in the top line on the screen. If you are certain that you want to bid this amount, then click on the “Submit bid” button in the middle of the screen. Your bid will then be entered on your behalf in this auction. If, however, you want to revise the number you entered, do not press the “Submit bid” button yet. Instead, enter the revised number in the squares in the lower half of the screen, and press the “Update value” button. Then the screen will be refreshed, and you have again the choice between “Submit bid” or “Update value”. You can revise your bid as many times as you want before finalizing it. Clicking the “Submit bid” button makes the chosen value your final bid for this auction.

After you and all other participants have clicked the “Submit bid” button, the computer ranks all seven bids in your group. Depending on whether or not your bid is among the lowest four bids in your group, one of two screens will appear.

*Example 1. Suppose that your bid is NOT among the four LOWEST bids in your group. Then the following screen will appear.*



You are bidder D.

Bids in increasing order  
(accepted bids in blue).

| Bid: | Participant in your group: |
|------|----------------------------|
| €    | F                          |
| €    | B                          |
| €    | A                          |
| €    | E                          |
| €    | C                          |
| €    | D                          |

The highest accepted bid was equal to €

**Your bid has NOT been accepted. If this auction is selected by the computer at the end of the experiment, you take your mug home.**

Continue

Help  
This screen shows the result of the auction. Please click the button in the bottom right corner to continue.  
Your results will be stored and shown in a bid history on the following screen.

On this screen, you are informed about the bids of all seven participants in your group, and also what the 4<sup>th</sup> lowest bid was – the highest bid that was accepted in this auction. You are also informed that your bid has NOT been accepted in this auction, because in this example we assumed that your bid was NOT among the four lowest bids in your group. That means that if, at the end of this session (after Part II has been completed too) the computer randomly selects this auction, you KEEP your mug and you can take it home with you.

In the bottom right corner, you can click on the “Continue” button to proceed to the next auction. We will come back to this after the second example.

Example 2: Suppose that your bid IS among the four LOWEST bids in your group. Then the following screen will appear.



Of course, this screen is very similar to the previous one. You receive the same information. That means that you are informed about the bids of all seven participants in your group, and also what the 4<sup>th</sup> lowest bid was – the highest bid that was accepted in this auction. However, in this case, you are informed that your bid has been ACCEPTED in this auction, because in this example we assumed that your bid was among the lowest four bids in your group. That means that if, at the end of this session (after Part II has been completed too) the computer randomly selects this auction, you have to HAND IN your mug. You do receive the price that you asked for in your bid.

In the bottom right corner, you can click on the “Continue” button to proceed to the next auction. The screen that will appear looks the same as Screen 1, except that in the top right corner of that screen, you will see the history of your bid decisions and auction outcomes in all previous auctions.

This completes the description of the screens.

Are there any questions at this point? Please raise your hand, and we will come to you to answer your questions.

If there are no further questions, we now continue with a short test. Please answer the following questions. When you have finished answering them, please raise your hand and we will come by to check your answers.

### Test questions Part I:

1. In Part I, you participate in 10 auctions. The six other participants in one auction are not necessarily the same individuals as the six participants you are matched with in another auction. Y/N
2. After you have entered your bid and pressed the “Update value” button, you can no longer revise it. Y/N
3. After you have pressed the “Submit bid” button, the value that is shown on the top line of the associated screen is the bid that you entered. You can no longer revise it. Y/N
4. Please circle the correct option. Suppose that, in an auction, your bid is the lowest bid. If, at the end of the session, this auction is randomly selected by the computer, you
  - a) can take your mug home with you, but you do not receive the amount of money that you asked for in your bid.
  - b) have to hand in your mug, but you do receive the amount of money that you asked for in your bid.
5. Please circle the correct option. Suppose that, in an auction, there are three participants that bid an amount smaller than your bid, and the bids of the remaining three participants are higher than your bid. If, at the end of the session, this auction is randomly selected by the computer, you
  - a) can take your mug home with you, but you do not receive the amount of money that you asked for in your bid.
  - b) have to hand in your mug, but you do receive the amount of money that you asked for in your bid.
6. Please circle the correct option. Suppose that, in an auction, there are four participants that bid an amount smaller than your bid, and the bids of the remaining two participants are higher than your bid. If, at the end of the session, this auction is randomly selected by the computer, you
  - a) can take your mug home with you, but you do not receive the amount of money that you asked for in your bid.

b) have to hand in your mug, but you do receive the amount of money that you asked for in your bid.

## **INSTRUCTIONS FOR PART II**

In this second and last part of the experiment, you participate in a similar auction as in Part I. In this auction, the item you can decide to sell is NOT the mug on your desk. The item is a “virtual good”: a token.

At the beginning of Part II, you will be informed what the value is of your virtual token. This value is expressed in points.

In this Part II, 1 point is worth 5 euro cents. 100 points are thus worth 5 Euros.

The value of your virtual token is randomly selected from a range between 0 and 150 points. The value is drawn independently for each participant.

In the auction, you can decide for how many points you are willing to sell your virtual token. The number that you submit, is called your bid.

In this auction, there are again 7 participants; you and six others. The six others are NOT the same six individuals as in Part I. The computer will randomly rematch all participants in groups of 7 at the beginning of Part II.

You can bid any number between 0 and 150 points. The computer ranks the bids of all seven participants in your group from the lowest bid to the highest bid. All participants submit their bids simultaneously. That means that at the moment that you submit your bid, you do not know what bids are submitted by any other participant.

If your bid IS among the lowest four bids in the auction, your bid is ACCEPTED. You sell your virtual token, and you receive a payment equal to the number of points that you asked for in your bid.

If your bid is NOT among the lowest four bids in the auction, your bid is NOT accepted. You keep your virtual token, and you receive the value of your virtual token that you were informed about at the beginning of Part II.

In this Part II there is JUST ONE auction. After all participants have submitted their bids, you are informed of the outcome of the auction you participated in, and you are informed about your earnings in this Part II.

This completes the description of Part II.

Next, the computer will randomly select which of the 10 auctions you participated in in Part I is implemented. You will be shown the outcome of that auction. Then the experiment is completed.

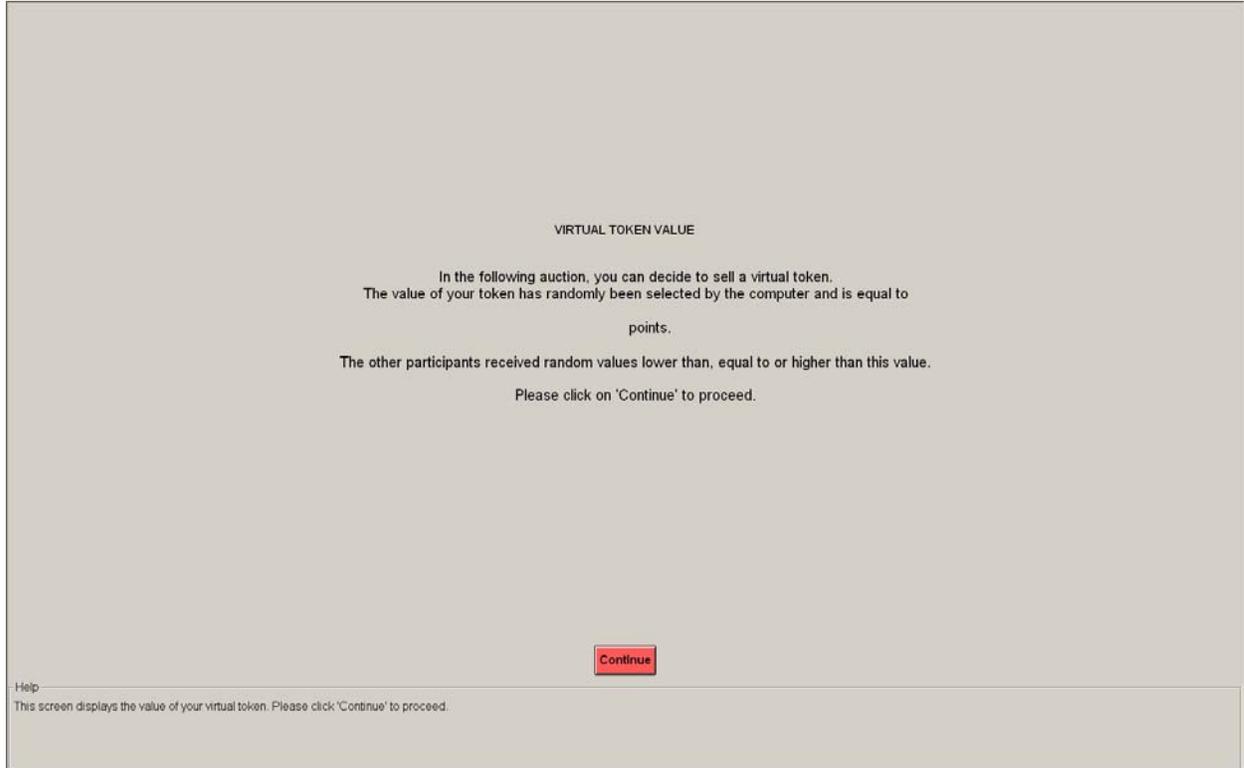
As stated before, all earnings will be paid to you via bank transfer within 48 hours.

This completes the description of the session. Let us now have a look at the screens of Part II.

## SCREENS

The first screen is the following.

### SCREEN 1:



This screen informs you about value of your virtual token. The computer assigns a random value between 0 and 150 points to the virtual token of each participant. The value assigned to the virtual token of each of the other six participants in your group is thus unlikely to be the same as the value assigned to your virtual token. Click the “Continue” button to proceed to the next screen.

SCREEN 2:

**Token auction**

My bid in the auction is **X** points.  
If my bid is among the 4 lowest bids in my group, I sell my token for the points stated in my bid.  
Otherwise, I receive the value of my token:    points.

Please choose **X** :

0,1,2,...,150 points

Enter a value between 0 and 150 points.

Help  
You received a token with a random value between 0 and 150 points. Please select a value for your bid to sell your token. Enter a value for your bid in the field above (between 0 and 150 points). Click on the 'Update value' button to display your selected value for X (this is not your final decision). If you are absolutely sure that this should be your bid, then click on the 'Submit bid' button. You can update your bid as many times as you want. Clicking the 'Submit bid' button makes the chosen value your final bid for this auction.

In this screen, you are requested to submit a bid. You can enter your bid (between 0 and 150 points) in the square field. Upon clicking the “Update value” button, the next screen appears.

SCREEN 3:

**Token auction**

My bid in the auction is    points.  
If my bid is among the 4 lowest bids  
in my group, I sell my token for the  
points stated in my bid.  
Otherwise, I receive the value of my  
token:    points.

I want to revise my bid :

(0,1,2,...,150 points)

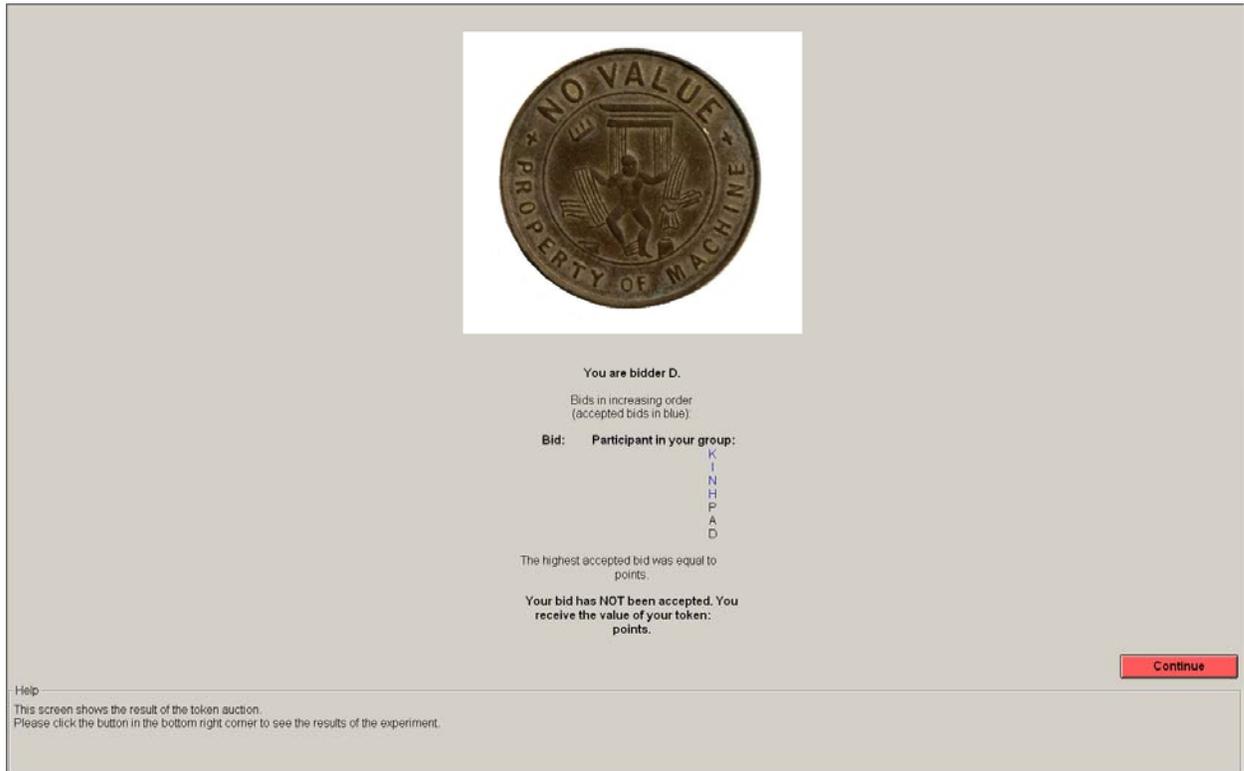
Enter a value between 0 and 150 points.

Help  
You received a token with a random value between 0 and 150 points. Please select a value for your bid to sell your token. Enter a value for your bid in the field above (between 0 and 150 points). Click on the "Update value" button to display your selected value for X (this is not your final decision). If you are absolutely sure that this should be your bid, then click on the "Submit bid" button. You can update your bid as many times as you want. Clicking the "Submit bid" button makes the chosen value your final bid for this auction.

The bid you entered, is shown on the top line. If you indeed want to submit this bid, press “Submit bid”. If you want to revise your bid, enter a new number in the field, and press “Update value” again. You can revise your bid as many times as you want before finalizing it. Clicking the “Submit bid” button makes the chosen number your final bid for this auction.

After you and all other participants have pressed “Submit bid”, the computer ranks all seven bids in your group. Depending on whether or not your bid is among the lowest four bids in your group, one of two following screens will appear.

*Example 1. Suppose that your bid is NOT among the four LOWEST bids in your group. Then the following screen will appear.*



On this screen, you are informed about the bids of all seven participants in your group, and also what the 4<sup>th</sup> lowest bid was – the highest bid that was accepted in the auction. You are also informed that your bid has NOT been accepted in this auction, because in this example we assumed that your bid was NOT among the four lowest bids in your group. That means that you do NOT sell your virtual token, and that your Part II earnings are equal to the value of your virtual token, as was conveyed to you in Screen 1 of Part II.

In the bottom right corner, you can click on the “Continue” button to finish the auction and proceed to a screen that summarizes your results in Part I and II. We will discuss this in a moment.

Example 2: Suppose that your bid IS among the four LOWEST bids in your group. Then the following screen will appear.



This screen is very similar to the one before. You are informed about the bids of all seven participants in your group, and also what the 4<sup>th</sup> lowest bid was – the highest bid that was accepted in the auction. However, in this case, you are informed that your bid has been ACCEPTED in this auction, because in this example we assumed that your bid was among the lowest four bids in your group. That means that you SELL your virtual token, and that your Part II earnings are equal to the bid that you submitted. In the bottom right corner, you can click on the “Continue” button to finish the auction and proceed to a screen that summarizes your results in Part I and II. It will also show you which auction of Part I is randomly selected to be implemented, and what your total earnings are in this session.

This completes the description of the screens.

Are there any questions at this point? Please raise your hand, and we will come to you to answer your questions.

If there are no further questions, we now continue with a short test. Please answer the following questions. When you have finished answering them, please raise your hand and we will come by to check your answers.

**Test questions Part II:**

1. In Part II, you participate in only one auction. The six other participants in this auction are the SAME six individuals you were matched with in the auctions in Part I. Y/N
  
2. Please circle the correct option. In Part II, the item that is auctioned, is
  - a) the mug in front of you.
  - b) a virtual good: a token.
  
3. After you have entered your bid and pressed the “Update value” button, you can no longer revise it. Y/N
  
4. After you have pressed the “Submit bid” button, the value that is shown on the top line of the associated screen is the bid that you entered. You can no longer revise it. Y/N
  
5. Please circle the correct option. If my bid in Part II is ACCEPTED, I receive
  - a) the value of my virtual token that I was informed about at the beginning of Part II.
  - b) the number of points I asked for in my bid.
  
6. Please circle the correct option. If my bid in Part II is NOT accepted, I receive
  - a) the value of my virtual token that I was informed about at the beginning of Part II.
  - b) the number of points I asked for in my bid.

## ***B: Experimental instructions Uniform sellers treatment***

### **INSTRUCTIONS**

You are about to participate in an experiment on individual decision making. Before we start, we would like to ask that you do not communicate with other people during this session. Please also turn off your mobile phone.

The experiment consists of two parts. The instructions for the first part, Part I, will be read out aloud now, and you are invited to read along. After completion of Part I of the experiment, you will receive the instructions for Part II, and then Part II will take place.

### **INSTRUCTIONS FOR PART I**

You receive €5 for being here today. The mug that you just received, is yours.

Depending on your decisions in Part I, you can take your mug home, but you may also decide to sell it back to the experimenters for a monetary payment.

Whether you take your mug home or sell it back for a payment in Part I is determined in a special kind of auction. In the auction format used in this session, the auction participants are not bidding to BUY an item, but to SELL an item. In this auction, you decide what price you are willing to sell your mug for. The price that you submit, is called your bid.

There are 7 participants in your group, you and 6 other individuals in this room. All participants submit their bids simultaneously. That means that at the moment that you submit your bid, you do not know what bid any other participant submits.

After all participants have submitted their bids, the computer will compare the bids of each of the seven participants in your group to the same PREDETERMINED price. No participant is informed of the predetermined price in any auction at the moment at which they submit their bids. We buy back the mugs from those participants whose bids are LOWER than or EQUAL to this predetermined price. If your bid is LOWER than or EQUAL to this predetermined price, your bid is ACCEPTED in this auction.

If your bid is HIGHER than this predetermined price, your bid is NOT accepted in this auction.

The auction will not just take place once; it will be repeated ten times. However, you only have one mug that you can keep, or sell. We implement this as follows. After both Part I and Part II have been completed, the computer randomly selects which of the ten auctions you participated in in Part I, will be implemented.

If, in that randomly selected auction, your bid was NOT accepted (that is, if it was HIGHER than the predetermined price), you take your mug home, as well as the €5 show-up fee plus any earnings you receive in Part II.

If, in that randomly selected auction, your bid was ACCEPTED (that is, if it was LOWER than or EQUAL to the predetermined price), you have to hand in your mug, but you receive the predetermined price in that auction, as well as the €5 show-up fee plus any earnings you receive in Part II.

All earnings will be paid to you via bank transfer within 48 hours.

Each of the ten auctions is independent, because the outcome of only one will be implemented.

We will now explain the auction rules that apply in each of the ten auctions you will participate in in more detail.

### **THE PROCEDURES**

Auctions take place with 7 participants in a group – you, and six other individuals in this room. You are matched with the SAME six participants in each of the ten auctions in Part I.

In each auction, you can bid any amount between 0.00 and 15.00 Euros. Bids can be in full Euros, but also in tens of euro cents. For example, you can bid Z Euros and 10 cents, Z Euros and 20 cents, etc., but not Z Euros and 15 cents, or Z Euros and 16 cents.

All participants submit their bids simultaneously. At the moment that you submit your bid, you thus do not know what bid is submitted by any other participant.

The predetermined price to which bids are compared, is the same for all participants in your group. No participant is informed of the predetermined price in any auction at the moment at which they submit their bids. The predetermined price is not necessarily the same in every auction. It can be lower than, equal to or higher than the predetermined price of the previous auction.

After all participants have submitted their bids, the computer will compare the bids of each of the seven participants in your group to the predetermined price for your group in that auction.

After the computer has compared all bids of your group to the predetermined price in that auction, you will be informed of the bids of the six other participants in your group. You will then also be informed about the predetermined price for your group in this auction, and whether your bid was ACCEPTED, or NOT.

If your bid is ACCEPTED in this auction (that is, if your bid is LOWER than or EQUAL to the predetermined price for your group in this auction) and if, at the end of the session (after both Part I and Part II have been completed), this auction is randomly selected by the computer, you receive the predetermined price of that auction, and you have to HAND IN your mug.

If your bid is NOT accepted in this auction (that is, if your bid is HIGHER than the predetermined price for your group in this auction) and if, at the end of the session (after both Part I and Part II have been completed), this auction is randomly selected by the computer, you KEEP your mug, and you do not receive the predetermined price of that auction.

This completes the description of the auction. The procedure is repeated ten times. The outcome of each of the ten auctions is thus whether your bid was ACCEPTED, or NOT, and one of these ten outcomes will be implemented at the end of the session. As stated before, the other bidders in all the auctions you participate in are always the same six individuals.

Let us now have a look at the screens.

## SCREENS

The first screen is the following.

### SCREEN 1:



The screenshot shows a web interface for an auction. At the top left, it says "Auction of 10". The main text reads: "My bid in the auction is € X.x. If my bid is lower than or equal to the predetermined price, I sell my mug for this predetermined price. Otherwise, I keep my mug." Below this, it asks the user to "Please choose € X.x:" and provides two input fields: one for the Euro amount (with a dropdown menu showing options 0, 1, 2, ..., 15) and one for the cents amount (with a dropdown menu showing options 0, 10, 20, ..., 90). A note below the fields says "Enter a value between € 0.00 and € 15.00 rounded to tens of euro cents." There is an "Update value" button. At the bottom, there is a "Help" section with instructions: "Please select a value for your bid. Enter a value for euros in the left field and a value for tens of euro cents in the right field. Click on the 'Update value' button to display your selected value for € X.x (this is not your final decision). If you are absolutely sure that this should be your bid in this auction, then click on the 'Submit bid' button. You can update your bid as many times as you want. Clicking the 'Submit bid' button makes the chosen value your final bid for this auction. The current auction is displayed in the top left corner."

On the top-left part of this screen, you are informed about which of the ten auctions you now participate in. On this screen you are requested to submit a bid. You can enter a value for Euros (in round numbers, 0,1,2,...,15) in the left field and a value for euro cents (in multiples of ten cents, 0, 10, 20, ...90 cents) in the right field – note that the 0 is preprinted, so enter “1” if you want to enter “10 cents”.

Suppose you entered a bid of X.x0 Euros. After clicking on the “Update value” button, the next screen will appear.

SCREEN 2:

Auction of 10

My bid in the auction is € 0 .  
If my bid is lower than or equal to the predetermined price, I sell my mug for this predetermined price.  
Otherwise, I keep my mug.

Submit bid

I want to revise my bid :

€ [ ] . [ ] 0  
0,1,2.....15 Euros 0,10,20.....90 cents

Enter a value between € 0.00 and € 15.00  
rounded to tens of euro cents.

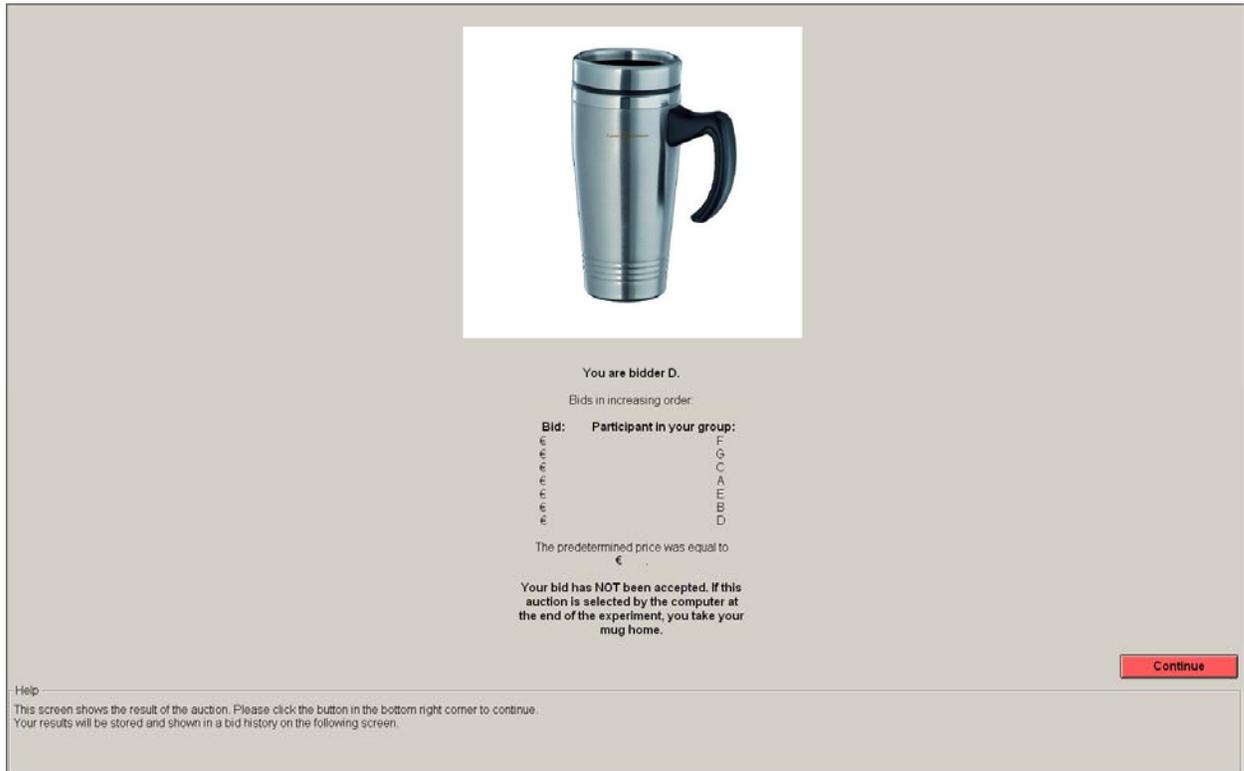
Update value

Help  
Please select a value for your bid. Enter a value for euros in the left field and a value for tens of euro cents in the right field. Click on the 'Update value' button to display your selected value for € X.x (this is not your final decision).  
If you are absolutely sure that this should be your bid in this auction, then click on the 'Submit bid' button.  
You can update your bid as many times as you want. Clicking the 'Submit bid' button makes the chosen value your final bid for this auction.  
The current auction is displayed in the top left corner.

The bid that you entered, will appear in the top line on the screen. If you are certain that you want to bid this amount, then click on the “Submit bid” button in the middle of the screen. Your bid will then be entered on your behalf in this auction. If, however, you want to revise the number you entered, do not press the “Submit bid” button yet. Instead, enter the revised number in the squares in the lower half of the screen, and press the “Update value” button. Then the screen will be refreshed, and you have again the choice between “Submit bid” or “Update value”. You can revise your bid as many times as you want before finalizing it. Clicking the “Submit bid” button makes the chosen value your final bid for this auction.

After you and all other participants have clicked the “Submit bid” button, the computer compares the bids of all seven participants in your group to the predetermined price for your group. Depending on whether your bid is lower than, equal to or higher than the predetermined price for your group in this auction, one of two screens will appear.

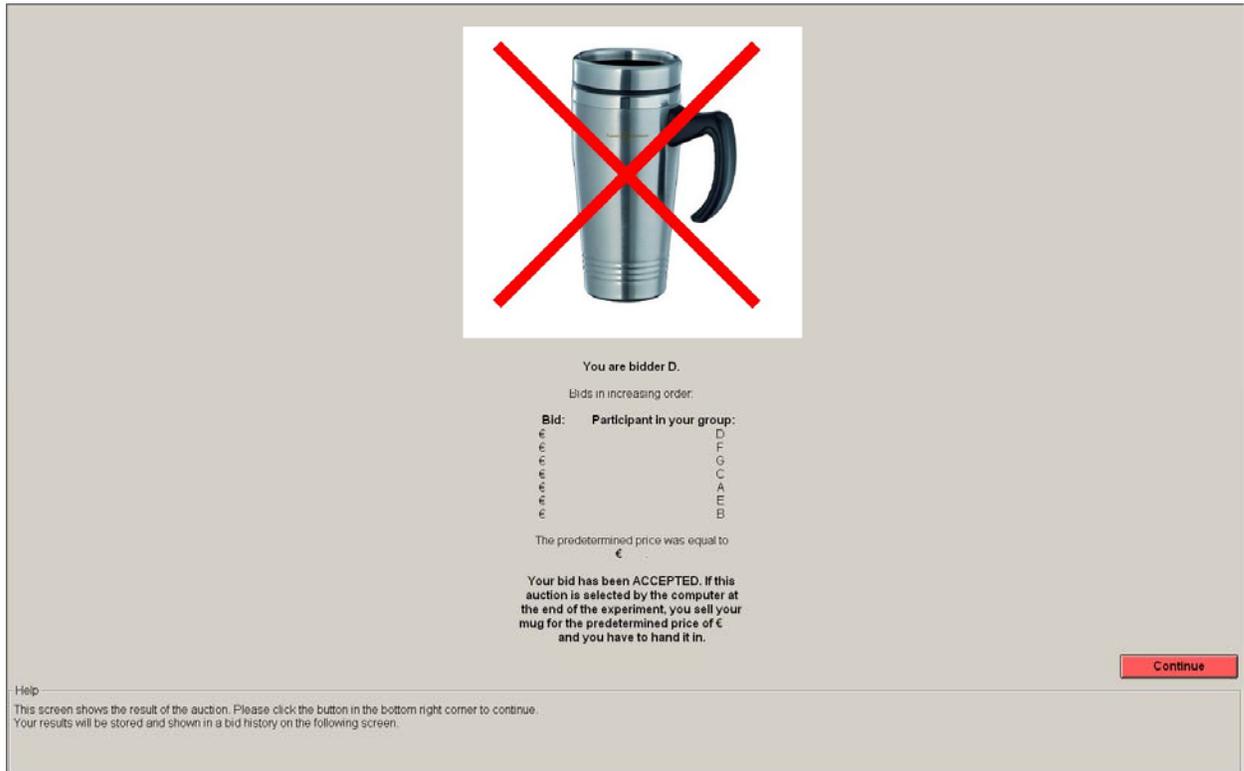
*Example 1. Suppose that your bid is HIGHER than the predetermined price. Then the following screen will appear.*



On this screen, you are informed about the bids of all seven participants in your group, and also what the predetermined price was in this auction. You are also informed that your bid has NOT been accepted in this auction, because in this example we assumed that your bid was HIGHER than the predetermined price for your group. That means that if, at the end of this session (after Part II has been completed too) the computer randomly selects this auction, you KEEP your mug and you can take it home with you.

In the bottom right corner, you can click on the “Continue” button to proceed to the next auction. We will come back to this after the second example.

Example 2: Suppose that your bid is LOWER than or EQUAL to the predetermined price. Then the following screen will appear.



Of course, this screen is very similar to the previous one. You receive the same information. That means that you are informed about the bids of all seven participants in your group, and also what the predetermined price was in this auction. However, in this case, you are informed that your bid has been ACCEPTED in this auction, because in this example we assumed that your bid was LOWER than or EQUAL to the predetermined price for your group. That means that if, at the end of this session (after Part II has been completed too) the computer randomly selects this auction, you have to HAND IN your mug. You do receive the predetermined price.

In the bottom right corner, you can click on the “Continue” button to proceed to the next auction. The screen that will appear looks the same as Screen 1, except that in the top right corner of that screen, you will see the history of your bid decisions and auction outcomes in all previous auctions.

This completes the description of the screens.

Are there any questions at this point? Please raise your hand, and we will come to you to answer your questions.

If there are no further questions, we now continue with a short test. Please answer the following questions. When you have finished answering them, please raise your hand and we will come by to check your answers.

**Test questions Part I:**

7. In Part I, you participate in 10 auctions. The six other participants in one auction are not necessarily the same individuals as the six participants you are matched with in another auction. Y/N
8. After you have entered your bid and pressed the “Update value” button, you can no longer revise it. Y/N
9. After you have pressed the “Submit bid” button, the value that is shown on the top line of the associated screen is the bid that you entered. You can no longer revise it. Y/N
10. Please circle the correct option. Suppose that, in an auction, your bid is below the predetermined price. If, at the end of the session, this auction is randomly selected by the computer, you
  - a) can take your mug home with you, but you receive neither the amount of money that you asked for in your bid, nor the predetermined price.
  - b) have to hand in your mug, but you do receive the amount of money that you asked for in your bid.
  - c) have to hand in your mug, but you do receive the predetermined price in that auction.
11. Please circle the correct option. Suppose that, in an auction, your bid is higher than the predetermined price. If, at the end of the session, this auction is randomly selected by the computer, you
  - a) can take your mug home with you, but you receive neither the amount of money that you asked for in your bid, nor the predetermined price.
  - b) have to hand in your mug, but you do receive the amount of money that you asked for in your bid.
  - c) have to hand in your mug, but you do receive the predetermined price in that auction.

## **INSTRUCTIONS FOR PART II**

In this second and last part of the experiment, you participate in a similar auction as in Part I. In this auction, the item you can decide to sell is NOT the mug on your desk. The item is a “virtual good”: a token.

At the beginning of Part II, you will be informed what the value is of your virtual token. This value is expressed in points.

In this Part II, 1 point is worth 5 euro cents. 100 points are thus worth 5 Euros.

The value of your virtual token is randomly selected from a range between 0 and 150 points. The value is drawn independently for each participant.

In the auction, you can decide for how many points you are willing to sell your virtual token. The number that you submit, is called your bid.

In this auction, there are again 7 participants; you and six others. The six others are NOT the same six individuals as in Part I. The computer will randomly rematch all participants in groups of 7 at the beginning of Part II.

You can bid any number between 0 and 150 points. All participants submit their bids simultaneously. That means that at the moment that you submit your bid, you do not know what bids are submitted by any other participant.

The computer compares the bids of all seven participants in your group to a predetermined number of points for your group. The predetermined number of points to which bids are compared, is the same for all participants in your group. No participant is informed of the predetermined number of points at the moment at which they submit their bids.

If your bid is LOWER than or EQUAL to this predetermined number of points, your bid is ACCEPTED. You sell your virtual token, and you receive a payment equal to the predetermined number of points.

If your bid is HIGHER than this predetermined number of points, your bid is NOT accepted. You keep your virtual token, and you receive the value of your virtual token that you were informed about at the beginning of Part II.

In this Part II there is JUST ONE auction. After all participants have submitted their bids, you are informed of the outcome of the auction you participated in, and you are informed about your earnings in this Part II.

This completes the description of Part II.

Next, the computer will randomly select which of the 10 auctions you participated in in Part I is implemented. You will be shown the outcome of that auction. Then the experiment is completed.

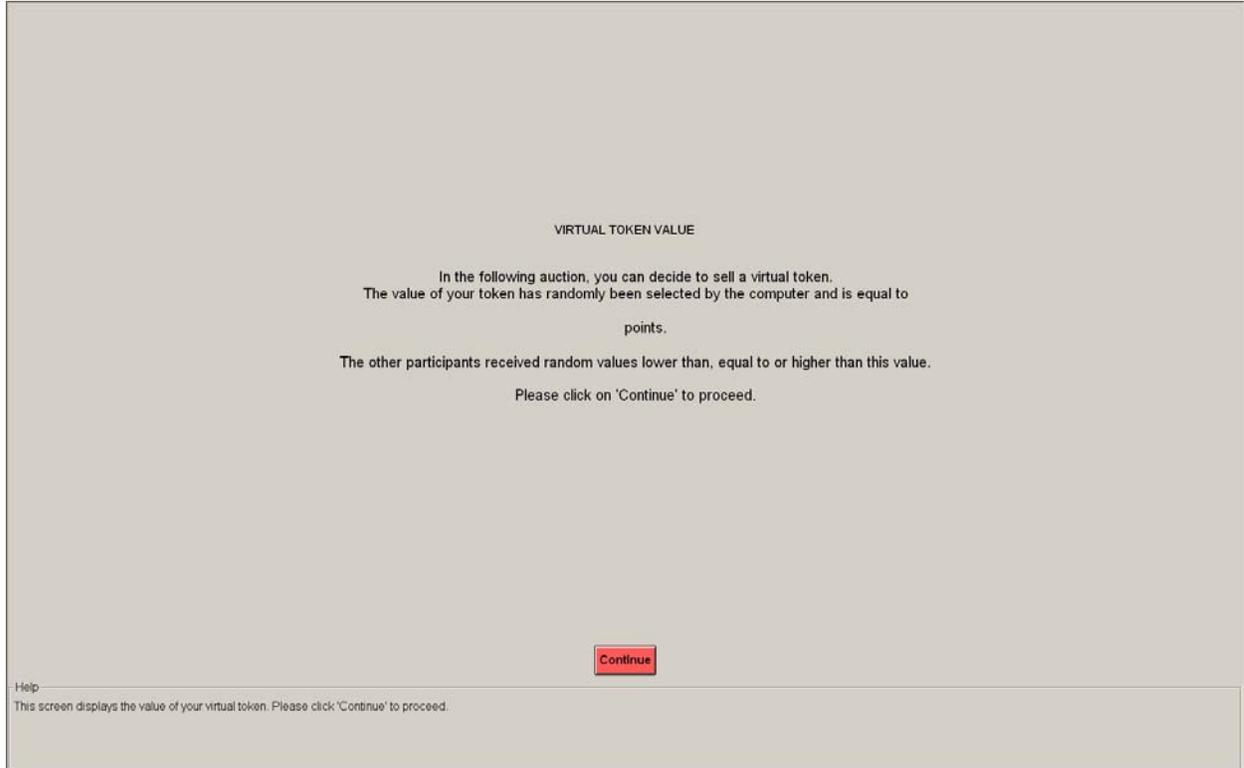
As stated before, all earnings will be paid to you via bank transfer within 48 hours.

This completes the description of the session. Let us now have a look at the screens of Part II.

## SCREENS

The first screen is the following.

### SCREEN 1:



This screen informs you about value of your virtual token. The computer assigns a random value between 0 and 150 points to the virtual token of each participant. The value assigned to the virtual token of each of the other six participants in your group is thus unlikely to be the same as the value assigned to your virtual token. Click the “Continue” button to proceed to the next screen.

SCREEN 2:

**Token auction**

My bid in the auction is **X** points.  
If my bid is **lower than or equal to** the predetermined price, I sell my token for this predetermined price. Otherwise, I receive the value of my token:    points.

Please choose **X** :

(0,1,2,...,150 points)

Enter a value between 0 and 150 points.

Help  
You received a token with a random value between 0 and 150 points. Please select a value for your bid to sell your token. Enter a value for your bid in the field above (between 0 and 150 points). Click on the 'Update value' button to display your selected value for X (this is not your final decision). If you are absolutely sure that this should be your bid, then click on the 'Submit bid' button. You can update your bid as many times as you want. Clicking the 'Submit bid' button makes the chosen value your final bid for this auction.

In this screen, you are requested to submit a bid. You can enter your bid (between 0 and 150 points) in the square field. Upon clicking the “Update value” button, the next screen appears.

SCREEN 3:

**Token auction**

My bid in the auction is    points.  
If my bid is **lower than or equal to**  
the predetermined price, I sell my  
token for this predetermined price.  
Otherwise, I receive the value of my  
token:    points.

I want to revise my **bid** :

(0,1,2,...,150 points)

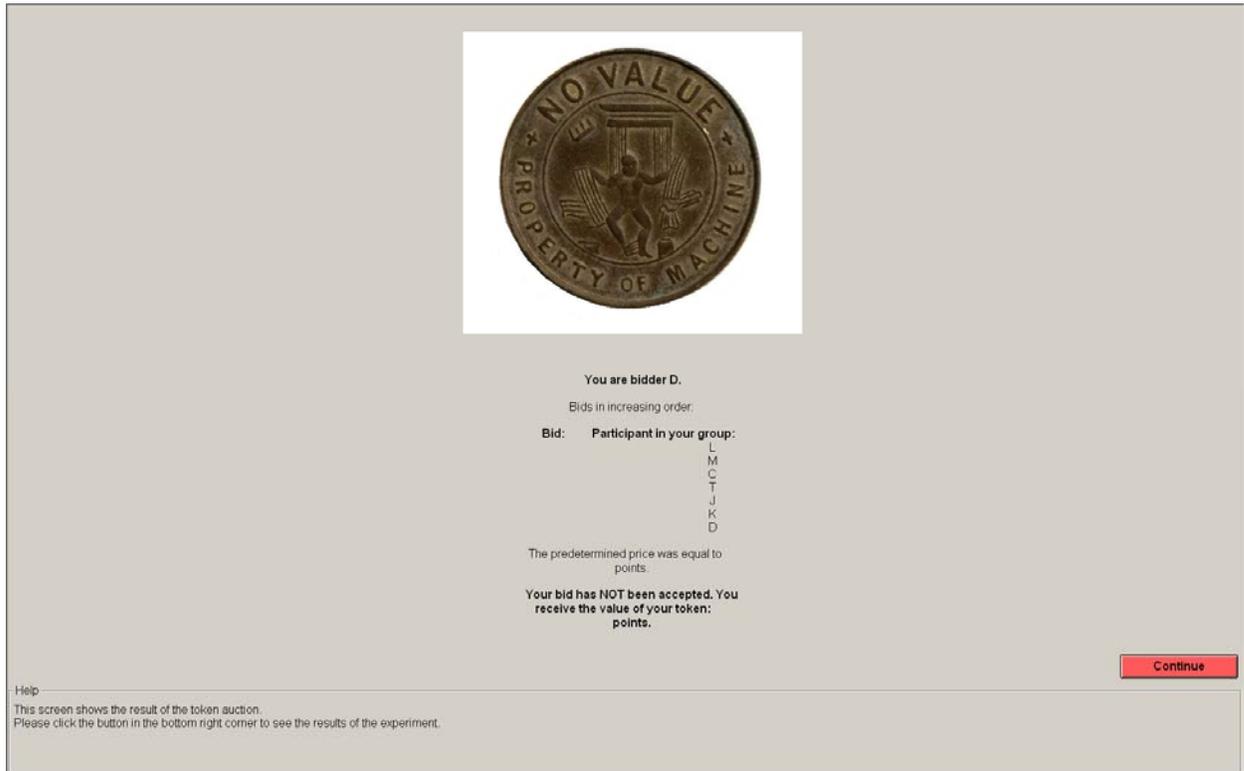
Enter a value between 0 and 150 points.

Help  
You received a token with a random value between 0 and 150 points. Please select a value for your bid to sell your token. Enter a value for your bid in the field above (between 0 and 150 points). Click on the "Update value" button to display your selected value for X (this is not your final decision). If you are absolutely sure that this should be your bid, then click on the "Submit bid" button. You can update your bid as many times as you want. Clicking the "Submit bid" button makes the chosen value your final bid for this auction.

The bid you entered, is shown on the top line. If you indeed want to submit this bid, press “Submit bid”. If you want to revise your bid, enter a new number in the field, and press “Update value” again. You can revise your bid as many times as you want before finalizing it. Clicking the “Submit bid” button makes the chosen number your final bid for this auction.

After you and all other participants have pressed “Submit bid”, the computer compares the bids of all seven participants to the predetermined number of points for your group. Depending on whether your bid is higher or lower than this predetermined number, one of two following screens will appear.

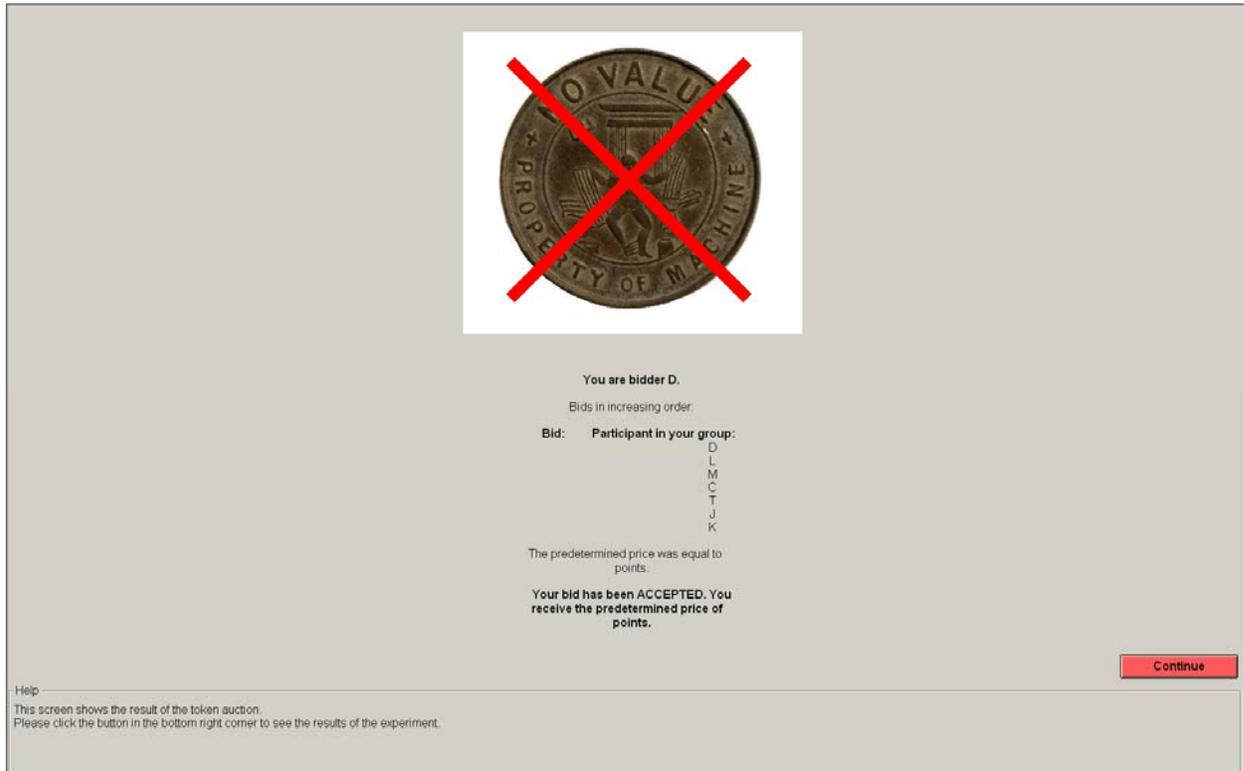
*Example 1. Suppose that your bid is HIGHER than the predetermined number of points. Then the following screen will appear.*



On this screen, you are informed about the bids of all seven participants in your group, and also what the predetermined number of points was of your group. You are also informed that your bid has NOT been accepted in this auction, because in this example we assumed that your bid was HIGHER than the predetermined number of points for your group. That means that you do NOT sell your virtual token, and that your Part II earnings are equal to the value of your virtual token, as was conveyed to you in Screen 1 of Part II.

In the bottom right corner, you can click on the "Continue" button to finish the auction and proceed to a screen that summarizes your results in Part I and II. We will discuss this in a moment.

Example 2: Suppose that your bid is LOWER than or EQUAL to the predetermined number of points. Then the following screen will appear.



This screen is very similar to the one before. You are informed about the bids of all seven participants in your group, and also what the predetermined number of points was of your group. However, in this case, you are informed that your bid has been ACCEPTED in this auction, because in this example we assumed that your bid was LOWER than or EQUAL to the predetermined number of points for your group. That means that you SELL virtual token, and that your Part II earnings are equal to the predetermined number of points.

In the bottom right corner, you can click on the “Continue” button to finish the auction and proceed to a screen that summarizes your results in Part I and II. It will also show you which auction of Part I is randomly selected to be implemented, and what your total earnings are in this session.

This completes the description of the screens.

Are there any questions at this point? Please raise your hand, and we will come to you to answer your questions.

If there are no further questions, we now continue with a short test. Please answer the following questions. When you have finished answering them, please raise your hand and we will come by to check your answers.

**Test questions Part II:**

7. In Part II, you participate in only one auction. The six other participants in this auction are the SAME six individuals you were matched with in the auctions in Part I. Y/N
  
8. Please circle the correct option. In Part II, the item that is auctioned, is
  - a) the mug in front of you.
  - b) a virtual good: a token.
  
9. After you have entered your bid and pressed the “Update value” button, you can no longer revise it. Y/N
  
10. After you have pressed the “Submit bid” button, the value that is shown on the top line of the associated screen is the bid that you entered. You can no longer revise it. Y/N
  
11. Please circle the correct option. If my bid in Part II is ACCEPTED, I receive
  - c) the value of my virtual token that I was informed about at the beginning of Part II.
  - d) the number of points I asked for in my bid.
  - e) the predetermined number of points.
  
12. Please circle the correct option. If my bid in Part II is NOT accepted, I receive
  - c) the value of my virtual token that I was informed about at the beginning of Part II.
  - d) the number of points I asked for in my bid.
  - e) the predetermined number of points.

### *C: Experimental instructions Uniform choosers treatment*

#### **INSTRUCTIONS**

You are about to participate in an experiment on individual decision making. Before we start, we would like to ask that you do not communicate with other people during this session. Please also turn off your mobile phone.

The experiment consists of two parts. The instructions for the first part, Part I, will be read out aloud now, and you are invited to read along. After completion of Part I of the experiment, you will receive the instructions for Part II, and then Part II will take place.

#### **INSTRUCTIONS FOR PART I**

You receive a show-up fee of €5 for being here today. In the front of the room, you see a mug.

Depending on your decisions in Part I, you receive a mug of that exact type, or a monetary payment.

Whether you receive a mug or a payment in Part I is determined in a special kind of auction. In the auction format used in this session, the auction participants are not bidding to BUY or SELL an item. In the auction used in this session, you indicate a price which is called your bid. For all payments LOWER than this bid, you choose to receive a mug. For all payments EQUAL to or HIGHER than this bid, you choose to receive the payment.

There are 7 participants in your group, you and 6 other individuals in this room. All participants submit their bids simultaneously. That means that at the moment that you submit your bid, you do not know what bid any other participant submits.

After all participants have submitted their bids, the computer will compare the bids of each of the seven participants in your group to the same PREDETERMINED price. No participant is informed of the predetermined price in any auction at the moment at which they submit their bids.

If your bid is LOWER than or EQUAL to the predetermined price, you receive this predetermined price.

If your bid is HIGHER than the predetermined price, you receive a mug.

The auction will not just take place once; it will be repeated ten times. However, you will receive either the predetermined price or a mug just once. We implement this as follows. After both Part I and Part II have been completed, the computer randomly selects which of the ten auctions you participated in in Part I, will be implemented.

If, in that randomly selected auction, your bid was NOT accepted (that is, if it was HIGHER than the predetermined price), you receive a mug that you can take home, as well as the €5 show-up fee plus any earnings you receive in Part II.

If, in that randomly selected auction, your bid was ACCEPTED (that is, if it was LOWER than or EQUAL to the predetermined price), you receive the predetermined price in that auction, as well as the €5 show-up fee plus any earnings you receive in Part II.

All earnings will be paid to you via bank transfer within 48 hours.

Each of the ten auctions is independent, because the outcome of only one will be implemented.

We will now explain the auction rules that apply in each of the ten auctions you will participate in in more detail.

### **THE PROCEDURES**

Auctions take place with 7 participants in a group – you, and six other individuals in this room. You are matched with the SAME six participants in each of the ten auctions in Part I.

In each auction, you can bid any amount between 0.00 and 15.00 Euros. Bids can be in full Euros, but also in tens of euro cents. For example, you can bid Z Euros and 10 cents, Z Euros and 20 cents, etc., but not Z Euros and 15 cents, or Z Euros and 16 cents.

All participants submit their bids simultaneously. At the moment that you submit your bid, you thus do not know what bid is submitted by any other participant.

The predetermined price to which bids are compared, is the same for all participants in your group. No participant is informed of the predetermined price in any auction at the moment at which they submit their bids. The predetermined price is not necessarily the same in every auction. It can be lower than, equal to or higher than the predetermined price of the previous auction.

After all participants have submitted their bids, the computer will compare the bids of each of the seven participants in your group to the predetermined price for your group in that auction.

After the computer has compared all bids of your group to the predetermined price in that auction, you will be informed of the bids of the six other participants in your group. You will then also be informed about the predetermined price for your group in this auction, and whether your bid was ACCEPTED, or NOT.

If your bid is ACCEPTED in this auction (that is, if your bid is LOWER than or EQUAL to the predetermined price for your group in this auction) and if, at the end of the session (after both Part I and Part II have been completed), this auction is randomly selected by the computer, you receive the predetermined price of that auction.

If your bid is NOT accepted in this auction (that is, if your bid is HIGHER than the predetermined price for your group in this auction) and if, at the end of the session (after both Part I and Part II have been completed), this auction is randomly selected by the computer, you receive a mug.

This completes the description of the auction. The procedure is repeated ten times. The outcome of each of the ten auctions is thus whether your bid was ACCEPTED, or NOT, and one of these ten outcomes will be implemented at the end of the session. As stated before, the other bidders in all the auctions you participate in are always the same six individuals.

Let us now have a look at the screens.

## SCREENS

The first screen is the following.

### SCREEN 1:



Auction of 10

My bid in the auction is € X.x.  
If my bid is lower than or equal to  
the predetermined price, I receive  
this predetermined price.  
Otherwise, I receive a mug.

Please choose € X.x :

€  .  0  
0,1,2,...,15 Euros| 0,10,20,...,90 cents

Enter a value between € 0.00 and € 15.00  
rounded to tens of euro cents.

Help  
Please select a value for your bid. Enter a value for euros in the left field and a value for tens of euro cents in the right field. Click on the 'Update value' button to display your selected value for € X.x (this is not your final decision).  
If you are absolutely sure that this should be your bid in this auction, then click on the 'Submit bid' button.  
You can update your bid as many times as you want. Clicking the 'Submit bid' button makes the chosen value your final bid for this auction.  
The current auction is displayed in the top left corner.

On the top-left part of this screen, you are informed about which of the ten auctions you now participate in. On this screen you are requested to submit a bid. You can enter a value for Euros (in round numbers, 0,1,2,...,15) in the left field and a value for euro cents (in multiples of ten cents, 0, 10, 20, ...90 cents) in the right field – note that the 0 is preprinted, so enter “1” if you want to enter “10 cents”.

Suppose you entered a bid of X.x0 Euros. After clicking on the “Update value” button, the next screen will appear.

SCREEN 2:

Auction of 10

My bid in the auction is € .  
If my bid is lower than or equal to  
the predetermined price, I receive  
this predetermined price.  
Otherwise, I receive a mug.

Submit bid

I want to revise my bid :

€ . 0  
0,1,2.....15 Euros 0,10,20.....90 cents

Enter a value between € 0.00 and € 15.00  
rounded to tens of euro cents.

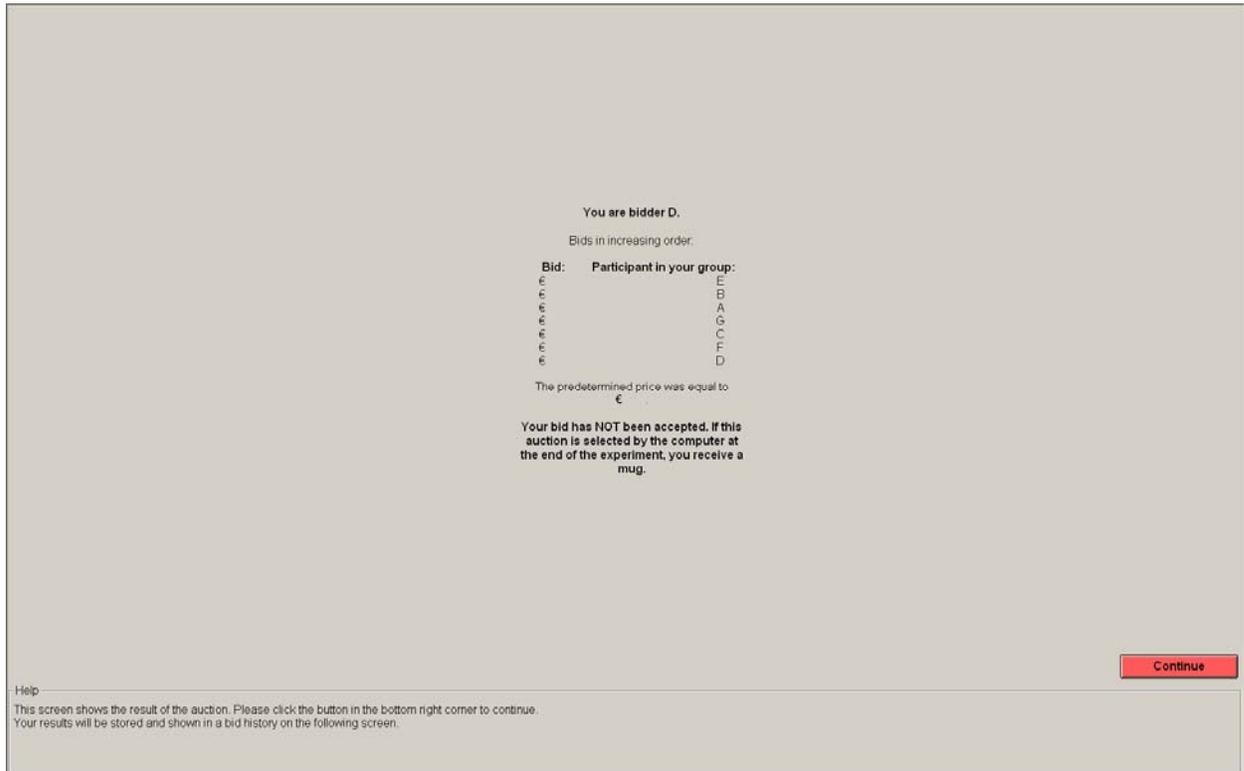
Update value

Help  
Please select a value for your bid. Enter a value for euros in the left field and a value for tens of euro cents in the right field. Click on the 'Update value' button to display your selected value for € X.x (this is not your final decision).  
If you are absolutely sure that this should be your bid in this auction, then click on the 'Submit bid' button.  
You can update your bid as many times as you want. Clicking the 'Submit bid' button makes the chosen value your final bid for this auction.  
The current auction is displayed in the top left corner.

The bid that you entered, will appear in the top line on the screen. If you are certain that you want to bid this amount, then click on the “Submit bid” button in the middle of the screen. Your bid will then be entered on your behalf in this auction. If, however, you want to revise the number you entered, do not press the “Submit bid” button yet. Instead, enter the revised number in the squares in the lower half of the screen, and press the “Update value” button. Then the screen will be refreshed, and you have again the choice between “Submit bid” or “Update value”. You can revise your bid as many times as you want before finalizing it. Clicking the “Submit bid” button makes the chosen value your final bid for this auction.

After you and all other participants have clicked the “Submit bid” button, the computer compares the bids of all seven participants in your group to the predetermined price for your group. Depending on whether your bid is lower than, equal to or higher than the predetermined price for your group in this auction, one of two screens will appear.

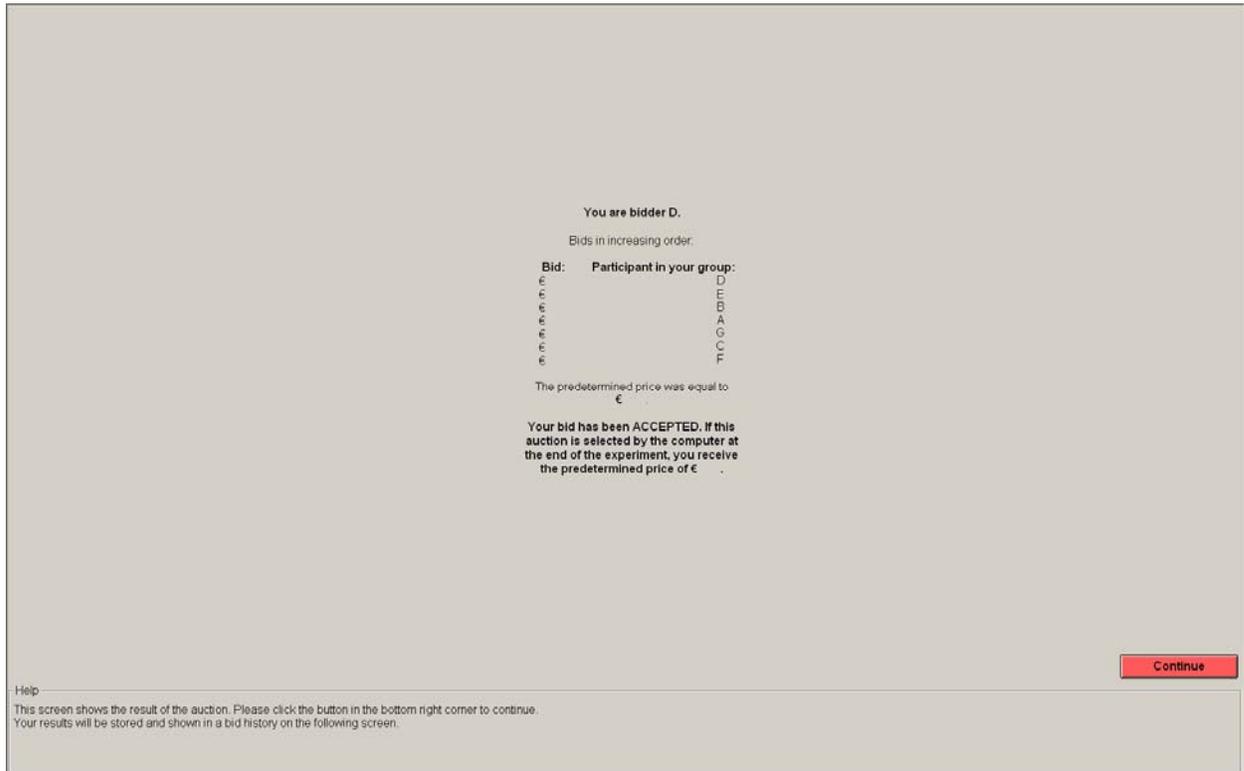
*Example 1. Suppose that your bid is HIGHER than the predetermined price. Then the following screen will appear.*



On this screen, you are informed about the bids of all seven participants in your group, and also what the predetermined price was in this auction. You are also informed that your bid has NOT been accepted in this auction, because in this example we assumed that your bid was HIGHER than the predetermined price for your group. That means that if, at the end of this session (after Part II has been completed too) the computer randomly selects this auction, you receive a mug that you can take home with you.

In the bottom right corner, you can click on the “Continue” button to proceed to the next auction. We will come back to this after the second example.

*Example 2: Suppose that your bid is LOWER than or EQUAL to the predetermined price. Then the following screen will appear.*



Of course, this screen is very similar to one in the previous example. You receive the same information. That means that you are informed about the bids of all seven participants in your group, and also what the predetermined price was in this auction. However, in this case, you are informed that your bid has been ACCEPTED in this auction, because in this example we assumed that your bid was LOWER than or EQUAL to the predetermined price for your group. That means that if, at the end of this session (after Part II has been completed too) the computer randomly selects this auction, you receive the predetermined price.

In the bottom right corner, you can click on the “Continue” button to proceed to the next auction. The screen that will appear looks the same as Screen 1, except that in the top right corner of that screen, you will see the history of your bid decisions and auction outcomes in all previous auctions.

This completes the description of the screens.

Are there any questions at this point? Please raise your hand, and we will come to you to answer your questions.

If there are no further questions, we now continue with a short test. Please answer the following questions. When you have finished answering them, please raise your hand and we will come by to check your answers.

**Test questions Part I:**

12. In Part I, you participate in 10 auctions. The six other participants in one auction are not necessarily the same individuals as the six participants you are matched with in another auction. Y/N
13. After you have entered your bid and pressed the “Update value” button, you can no longer revise it. Y/N
14. After you have pressed the “Submit bid” button, the value that is shown on the top line of the associated screen is the bid that you entered. You can no longer revise it. Y/N
15. Please circle the correct option. Suppose that, in an auction, your bid is below the predetermined price. If, at the end of the session, this auction is randomly selected by the computer, you
- a) receive a mug. You receive neither the amount of money that you indicated in your bid, nor the predetermined price.
  - b) do not receive a mug. You receive the amount of money that you indicated in your bid.
  - c) do not receive a mug. You receive the predetermined price in that auction.
16. Please circle the correct option. Suppose that, in an auction, your bid is higher than the predetermined price. If, at the end of the session, this auction is randomly selected by the computer, you
- a) receive a mug. You receive neither the amount of money that you indicated in your bid, nor the predetermined price.
  - b) do not receive a mug. You receive the amount of money that you indicated in your bid.
  - c) do not receive a mug. You receive the predetermined price in that auction.

## **INSTRUCTIONS FOR PART II**

In this second and last part of the experiment, you participate in a similar auction as in Part I. In this auction, you are again asked to choose between receiving a monetary payment and receiving an item. In this Part II, the item you may receive is NOT a mug as displayed in the front of the room. The item is a “virtual good”: a token.

At the beginning of Part II, you will be informed what your value is of the virtual token. This value is expressed in points.

In this Part II, 1 point is worth 5 euro cents. 100 points are thus worth 5 Euros.

The value of the virtual token is randomly selected from a range between 0 and 150 points. The value is drawn independently for each participant.

In the auction, you indicate a number of points which is called your bid. For all payments EQUAL to or HIGHER than this bid, you choose to receive the payment. For all payments LOWER than this bid, you choose to receive your value of the virtual token.

In this auction, there are again 7 participants; you and six others. The six others are NOT the same six individuals as in Part I. The computer will randomly rematch all participants in groups of 7 at the beginning of Part II.

You can bid any number between 0 and 150 points. All participants submit their bids simultaneously. That means that at the moment that you submit your bid, you do not know what bids are submitted by any other participant.

The computer compares the bids of all seven participants in your group to a predetermined number of points for your group. The predetermined number of points to which bids are compared, is the same for all participants in your group. No participant is informed of the predetermined number of points at the moment at which they submit their bids.

If your bid is LOWER than or EQUAL to this predetermined number of points, your bid is ACCEPTED. You receive a payment equal to the predetermined number of points.

If your bid is HIGHER than this predetermined number of points, your bid is NOT accepted. You receive the value of the virtual token that you were informed about at the beginning of Part II.

In this Part II there is JUST ONE auction. After all participants have submitted their bids, you are informed of the outcome of the auction you participated in, and you are informed about your earnings in this Part II.

This completes the description of Part II.

Next, the computer will randomly select which of the 10 auctions you participated in in Part I is implemented. You will be shown the outcome of that auction. Then the experiment is completed.

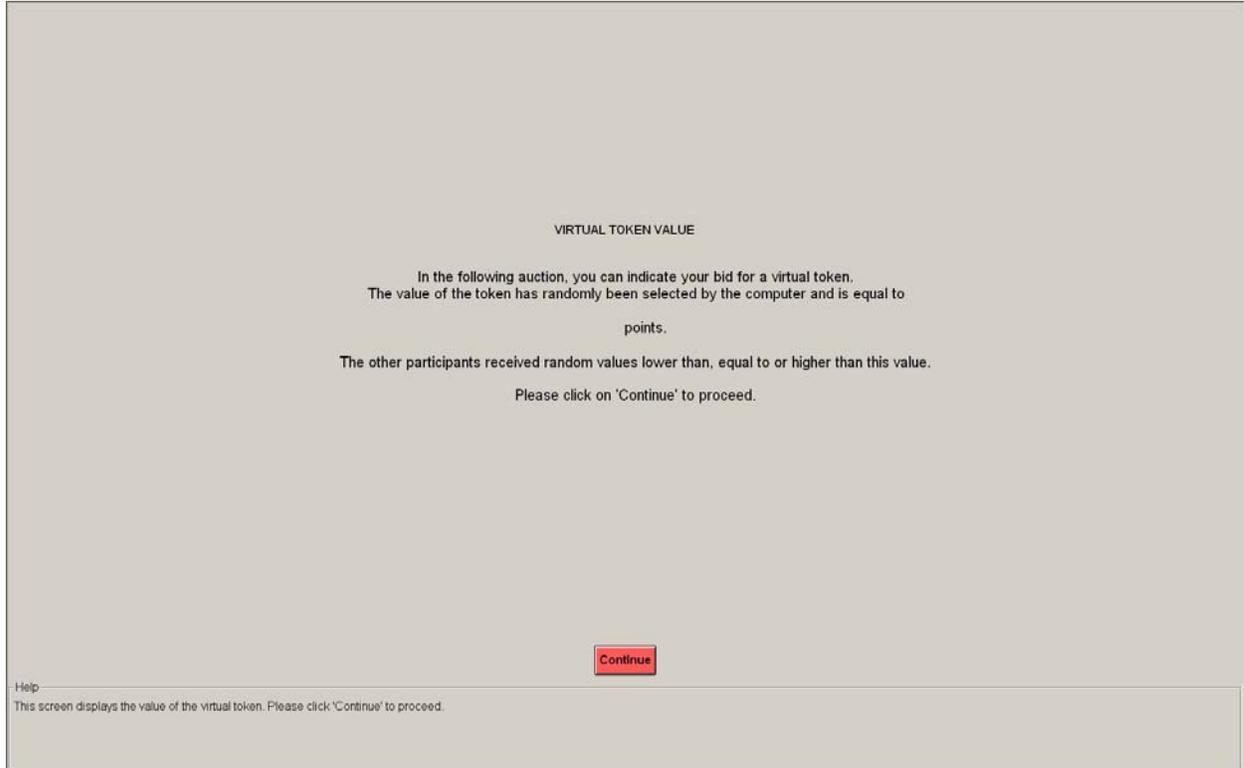
As stated before, all earnings will be paid to you via bank transfer within 48 hours.

This completes the description of the session. Let us now have a look at the screens of Part II.

## SCREENS

The first screen is the following.

### SCREEN 1:



This screen informs you about value of the virtual token. The computer assigns a random value between 0 and 150 points to the virtual token that each participant may receive. The value assigned to the virtual token that each of the other six participants in your group may receive, is thus unlikely to be the same as the value assigned to the virtual token that you may receive. Click the “Continue” button to proceed to the next screen.

SCREEN 2:

**Token auction**

My bid in the auction is **X** points.  
If my bid is **lower than or equal to**  
the predetermined price, I receive  
this predetermined price.  
Otherwise, I receive the value of the  
token:    points.

Please choose **X** :

0,1,2,...,150 points

Enter a value between 0 and 150 points.

Help  
You received a token with a random value between 0 and 150 points. Please select a value for your bid to sell the token. Enter a value for your bid in the field above (between 0 and 150 points). Click on the 'Update value' button to display your selected value for X (this is not your final decision). If you are absolutely sure that this should be your bid, then click on the 'Submit bid' button.  
You can update your bid as many times as you want. Clicking the 'Submit bid' button makes the chosen value your final bid for this auction.

In this screen, you are requested to submit a bid. You can enter your bid (between 0 and 150 points) in the square field. Upon clicking the “Update value” button, the next screen appears.

SCREEN 3:

**Token auction**

My bid in the auction is      points.  
If my bid is **lower than or equal to**  
the predetermined price, I receive  
this predetermined price.  
Otherwise, I receive the value of the  
token:      points.

I want to revise my **bid** :

(0,1,2,...,150 points)

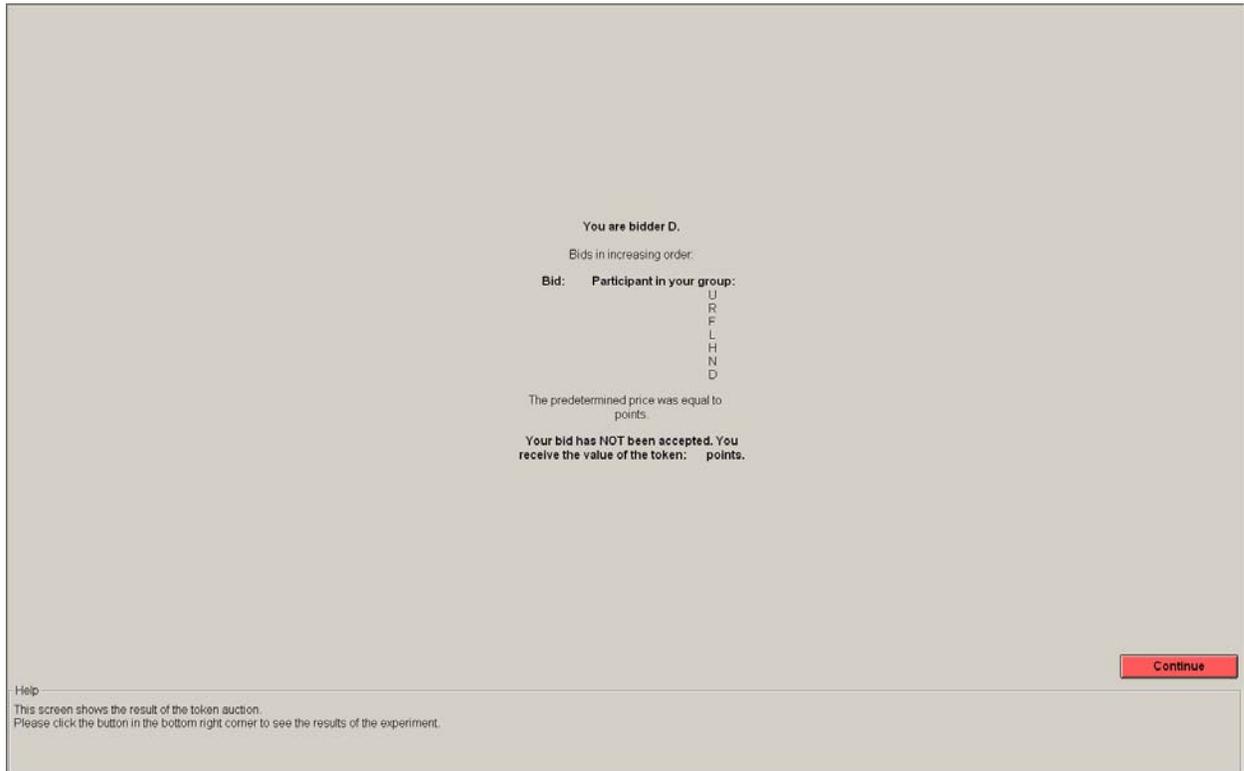
Enter a value between 0 and 150 points.

Help  
You received a token with a random value between 0 and 150 points. Please select a value for your bid to sell the token. Enter a value for your bid in the field above (between 0 and 150 points). Click on the 'Update value' button to display your selected value for X (this is not your final decision). If you are absolutely sure that this should be your bid, then click on the 'Submit bid' button.  
You can update your bid as many times as you want. Clicking the 'Submit bid' button makes the chosen value your final bid for this auction.

The bid you entered, is shown on the top line. If you indeed want to submit this bid, press “Submit bid”. If you want to revise your bid, enter a new number in the field, and press “Update value” again. You can revise your bid as many times as you want before finalizing it. Clicking the “Submit bid” button makes the chosen number your final bid for this auction.

After you and all other participants have pressed “Submit bid”, the computer compares the bids of all seven participants to the predetermined number of points for your group. Depending on whether your bid is higher or lower than this predetermined number, one of two screens will appear.

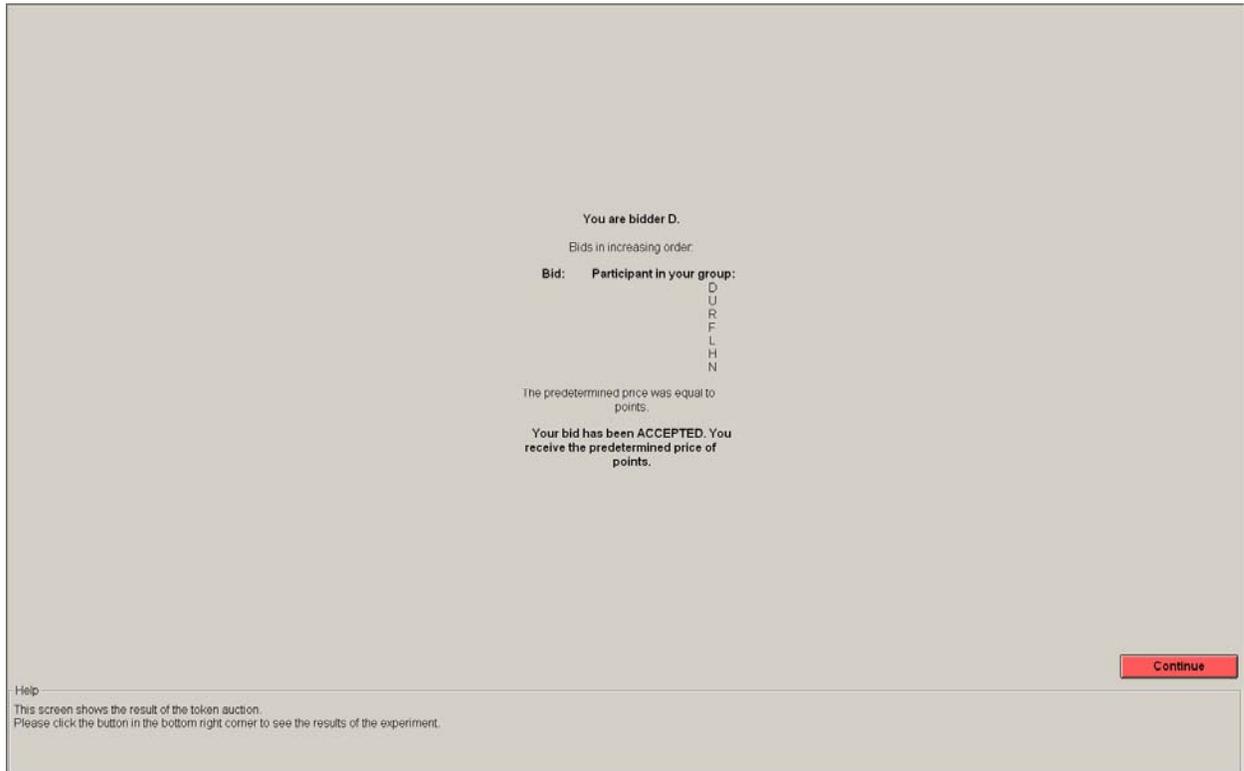
*Example 1: Suppose that your bid is HIGHER than the predetermined number of points. Then the following screen will appear.*



On this screen, you are informed about the bids of all seven participants in your group, and also what the predetermined number of points was for your group. You are also informed that your bid has NOT been accepted in this auction, because in this example we assumed that your bid was HIGHER than the predetermined number of points for your group. That means that you receive the virtual token, and that your Part II earnings are equal to the value of the virtual token, as was conveyed to you in Screen 1 of Part II.

In the bottom right corner, you can click on the “Continue” button to finish the auction and proceed to a screen that summarizes your results in Part I and II. We will discuss this in a moment.

*Example 2: Suppose that your bid is LOWER than or EQUAL to the predetermined number of points. Then the following screen will appear.*



This screen is very similar to the one before. You are informed about the bids of all seven participants in your group, and also and also what the predetermined number of points was of your group. However, in this case, you are informed that your bid has been ACCEPTED in this auction, because in this example we assumed that your bid was LOWER than or EQUAL to the predetermined number of points for your group. That means that you receive the predetermined number of points, and that your Part II earnings are equal to this predetermined number of points.

In the bottom right corner, you can click on the “Continue” button to finish the auction and proceed to a screen that summarizes your results in Part I and II. It will also show you which auction of Part I is randomly selected to be implemented, and what your total earnings are in this session.

This completes the description of the screens.

Are there any questions at this point? Please raise your hand, and we will come to you to answer your questions.

If there are no further questions, we now continue with a short test. Please answer the following questions. When you have finished answering them, please raise your hand and we will come by to check your answers.

**Test questions Part II:**

13. In Part II, you participate in only one auction. The six other participants in this auction are the SAME six individuals you were matched with in the auctions in Part I. Y/N
  
14. Please circle the correct option. In Part II, you can choose to receive either a payment, or
  - a) a mug as displayed in the front of the room.
  - b) a virtual good: a token.
  
15. After you have entered your bid and pressed the “Update value” button, you can no longer revise it. Y/N
  
16. After you have pressed the “Submit bid” button, the value that is shown on the top line of the associated screen is the bid that you entered. You can no longer revise it. Y/N
  
17. Please circle the correct option. If my bid in Part II is ACCEPTED, I receive
  - f) the value of the virtual token that I was informed about at the beginning of Part II.
  - g) the number of points I indicated in my bid.
  - h) the predetermined number of points for this auction.
  
18. Please circle the correct option. If my bid in Part II is NOT accepted, I receive
  - f) the value of the virtual token that I was informed about at the beginning of Part II.
  - g) the number of points I indicated in my bid for this auction.
  - h) the predetermined number of points.